INTRODUCTION TO PSYCHOLOGY

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INTRODUCTION TO PSYCHOLOGY

PART ONE

INTRODUCTORY DISCUSSION, LEADING TO A DEFINITION OF PSYCHOLOGY

CHAPTER I

THE PLAN, PURPOSE, AND USE OF THIS TEXT-BOOK

"Keep the student doing things, instead of merely listening, reading, or seeing them done. Fit the course to his capacity. Make him feel responsible for every step that he takes. Keep him working under pressure for accuracy and detail. Make him sure that he has the means for complying with every request. Recognize results. Even if he is to be entertained in the course, let it be most frequently by his own activity."—C. E. Seashore: On the teaching of the elementary course in psychology. *Psychological Monographs*, vol. 12, no. 4, p. 83. 1910.

This chapter contains prefatory material. It is not called a preface, because it is intended to be read!

This book is an outline of psychology.—There are two types of text-books of psychology: the outline and the manual. They differ in purpose and content. An outline is intended primarily to give students a general view of the subject-matter, aims, methods, values, and relations of the science. A manual serves, rather, to present the materials of the science as a definitely organized body of knowledge. The former is a sketch of the science: the latter is a compendium of facts. Unfortunately, both for them and the science, not a few students are introduced to psychology by a manual instead of by an outline. This experience is unfortunate, because only the exceptionally industrious or

able student ever discovers what the subject really is and may mean. The manual so overwhelms the average beginner that he loses himself in a turmoil of facts, and remains unappreciative of the science, because he knows neither its aims nor its relations. It is just as important in psychology as in forestry that one should see the wood clearly and understand its general characteristics before undertaking to study its individual trees in detail.

An outline should be a living skeleton.—A bird's-eye view of a subject aids one greatly in appreciating its particular facts. Every outline of a science is a skeleton. If it is a good outline, it is a living skeleton which insists upon being clothed with facts. Indeed, its value may fairly be measured in terms of the power it has to impel us to seek information. An outline of psychology should offer the reader a clear-cut and vivid picture of the science, in which the essential features are made so prominent that they cannot be overlooked even by the careless and inattentive reader. Moreover, the skeleton-picture impressed upon the mind of an intelligent reader by such an outline should continue to attract to itself facts throughout his life.

The manual of psychology should follow and supplement the outline.—A reliable and readable manual is invaluable in any science, for once the earnest and energetic student has acquired his skeleton-picture, he is prepared to read manuals, source books, monographs, and other reports of investigations with keen interest and with rapidly increasing profit. The point is that in psychology, as in other subjects, one must feel the need of information before one can seek it with enthusiasm.

It is true that a manual read with industry and held in memory lends one the appearance of knowledge, but it is equally true that such information has little value unless one really understands the subject. One must have a general knowledge of the aims and ideals of psychology in

order to appreciate its facts. It is such a "general knowledge" that Part One of this text-book is intended to provide.

The plan of a text-book should be obvious.—Too often it is either impossible or extremely difficult for the student to discover a plan in his teacher's presentation of psychology. He is aware only of a confused and unintelligible collection of facts. Usually the confusion and unintelligibility would disappear if the plan were grasped.

What the class-room teacher can do from day to day by class-experiments, discussions, conferences, quizes, and written exercises, the writer has only one opportunity to accomplish. If he does not make clear, at the beginning of his book, the way in which he is planning to present the subject, his work may prove worse than valueless.

To speak of an outline of an outline seems like undue simplification. Nevertheless, it has been necessary for the writer to follow a definite plan in working out this book and it is equally necessary that the reader should understand the plan.

This text-book is intended as a simple skeleton-picture of the science of psychology.—Its purpose is two-fold. First, to give the reader a definite idea of what the science of psychology is trying to do. Second, to make the beginner realize that he is at the threshold of a subject which is as interesting as it is important, and to arouse a desire to know it intimately. The book must be considered a failure if it does not lead naturally to continued study of mental life and to an increase in interest which keeps pace with the accumulation of knowledge and development of insight.

The book is divided into six main parts.—The first part is introductory and each of the other five deals with one of the tasks of psychology.

In Part One the nature of the materials, aims, methods,

and values of the science is discussed briefly and simply in order that the reader may be helped to formulate a working definition of psychology. This part of the book is in reality an essay on the subject, What is the science of psychology? What does it attempt to do, and how, and why?

The remaining five parts deal respectively with the several tasks of (1) *Description,* (2) *Genetic description* or *history,* (3) *Generalization,* (4) *Explanation and correlation,* and (5) *Control.*

Part Two considers the task of description in psychology, together with some of its results. This task is fulfilled by the application of the methods of analysis and synthesis to the materials of the science.

Part Three similarly treats of genetic description or the history of consciousness. This is only a special aspect or part of the general task of description, but it depends upon methods which in certain important respects differ from those of simple description.

Part Four discusses the task of generalization. In this portion of the book the principles and laws of psychology are presented. A part of the book has been devoted to this special topic in order to emphasize the fact that the science has a respectable body of generalizations.

Part Five is concerned, first of all, with the explanation of psychological facts. It gives examples of various kinds of scientific explanation and offers an account of the nature of psychological explanation. Secondarily, this part of the book discusses the relation of body and mind, and attempts to correlate processes in the body with mental processes.

Part Six has to do with the task of control, for psychology is confronted by a demand for such knowledge of mental life as is necessary for the intelligent control of consciousness.

The importance of questions concerning an author's plan and purpose.—It is well worth while to try to discover reasons for the selection of the materials of a text-book and for the arrangement of parts. In connection with this particular outline the following questions may be suggested as pertinent. Why is there no account of either the structure or functions of the nervous system? Why is the subject-matter of the science presented according to the kinds of things done instead of according to the varieties of material studied? Why does the book contain a special part dealing with principles and laws whereas other text-books have no such prominent division? Why does the book discuss the correlation of bodily with mental processes? Why are two kinds of description brought into prominence side by side? Why is so much space, relatively, devoted to the introductory part? Why are aims and methods made more prominent than results?

These are examples of the kinds of question the student should ask during the reading of the book, and be prepared to answer in quizes or in written reports. It is readily noted that the necessity of answers to such questions forces the reader to try to understand the point of view and purpose of the writer of the text. It is, indeed, an excellent practice to get into the habit of reading with definite questions in mind.

How can we best study psychology.—The employment of questions as an aid to the intelligent reading of this book has been suggested for the following reason. Most of us can listen indefinitely to lectures on subjects in which we have no special interest, or we can read diligently for hours, without gaining information or insight. This seems incredible to some fortunate individuals, but it nevertheless is true of the majority of students.

Now, it is the task of the teacher of psychology to elicit or force attentive and intelligent listening and reading.

There are many ways of attempting to do this, but best among them are those which compel reaction. If things are so arranged that we must do something, and if doing this something properly depends upon knowing or understanding, we are reasonably certain to strive to know and understand. The circumstances of our everyday business life constantly force us to react in the light of knowledge. Those who act without knowing pay for their ignorance with failure. If we are forced to work out problems, write reports, answer questions, the necessity for action stimulates our search for knowledge and understanding.

It is a matter of common knowledge that those who with definite problems in mind study a subject acquire knowledge and insight with great rapidity. This is simply because they are seeking to learn how to do something. The teacher of psychology who can get a student interested in the solution of some psychological problem, no matter how trivial, or in learning how to perform some experiment, or even how to answer some simple question of fact upon which reaction depends, has achieved success. As students we do not wish or intend to waste our time: we simply do not know how to avoid wasting it. Hence it is that instruction concerning certain principles of attention and methods of work proves both acceptable and invaluable at the beginning of the study of psychology. One excellent way to force reaction is to require written answers to questions; another is to require the performance of simple experiments and the writing of accurate accounts of the procedure and its results.

The class-experiment in psychology.—The latter of these methods has been adopted in this book, for it has been the experience of the writer that it does much to make the study of psychology interesting and helpful.

At the end of each chapter there is given the description of an exercise, or class-experiment, not necessarily closely

related to the topic of the chapter, which may be performed by the class as a group, in about thirty minutes. The instructor should act as experimenter, controlling the physical conditions under which the members of the class introspect; and each student should observe, as faithfully as he can, what goes on in his consciousness, and write a systematic and accurate account of his results.

The exercises are intended (1) to provide each student with a number of favorable opportunities for the study of his consciousness, (2) to give him such glimpses of his mental life as will lead him to study it thoroughly, (3) to furnish valuable training in scientific method, and (4) to help to establish valuable habits of working.

The use of supplementary reading in connection with this text-book.—This book is simply an outline of psychology. It is not complete or exhaustive. Therefore, it has seemed desirable to give, at the conclusion of each chapter, a few references to valuable discussions of special topics. These references are sometimes to other text-books and sometimes to special papers or monographs. Those students who are able to do this additional reading will thereby gain a truer conception of the science of psychology and a more profitable knowledge of mental life than the reading of this outline can give. The attempt has been made, however, so to write the book that it shall be intelligible and serviceable apart from the use of any other psychological literature. In itself the work is complete as an outline of psychology, but at every point it should tend to lead the reader beyond its narrow limits.

It is the practice of the writer to use this outline as the basis of his presentation of psychology, and to urge students to read in connection with it such works as Professor Thorndike's "Elements of Psychology" and Professor Calkins' "First Book in Psychology," in order that they may get the points of view of different psychologists. As manuals,

Professor Titchener's "A Text-book of Psychology" and Professor Sully's "A Teacher's Handbook of Psychology" are invaluable.

Self-observation.—Each chapter opens with a "text," in order that the reader may be reminded frequently that self-observation is absolutely necessary if one is to be a psychologist. It has been the writer's aim to select for quotation valuable bits of introspection. These "texts" are not, in all cases, closely related to the topics of the chapter, for they are intended merely to emphasize the importance of introspection.

CLASS EXERCISE

Self-observation. The introspection of a memory consciousness. Materials: paper and pen or pencil.

Answer immediately, and without stopping to count, the question, Which is the middle letter of the alphabet? If any student in the class has already read this paragraph, the instructor should institute a similar question whose answer has not been thought out.

Each member of the class should immediately write his answer on a loose sheet of paper, and describe as accurately as possible the mental process by which he arrived at the answer.

After the writing has been completed the instructor may describe his own introspection in connection with the question, or that of other practiced observers of consciousness, and discuss the task and the individual results with the class.

SUPPLEMENTARY READING

Calkins, M. W.: The teaching of elementary psychology in colleges supposed to have no laboratory. *Psychological Monographs*, vol. 12, no. 4, pp. 41-53. 1910.

Sanford, E. C.: The teaching of elementary psychology in colleges and universities with laboratories. Same, pp. 54-71.

Seashore, C. E.: The teaching of the elementary course in psychology. Same, pp. 80-91.

Whipple, G. M.: The teaching of psychology in normal schools. Same, pp. 2-40.

Angell, J. R.: Laboratory courses and equipment in psychology for colleges and universities. Same, pp. 72-79.

CHAPTER II

THE SUBJECT-MATTER, BRANCHES, AND RELATIONS OF PSYCHOLOGY

THE PSYCHOLOGIST—" A man keenly interested in mind, with no purpose beyond mind; a man enamored of introspection; a man to whom the most fascinating thing in the universe is the human consciousness; a man to whom successful analysis of an unresolved mental complex is as the discovery of a new genus to the zoölogist or a new river to the explorer; a man who lives in direct companionship with his mental processes as the naturalist lives with the creatures which are ordinarily shunned or ignored; a man to whom the facts and laws of mind are, if I may so put it, the most real things that the world can show."—TITCHENER, E. B.: The problems of experimental psychology. *American Journal of Psychology*, vol. 16, p. 220. 1905.

The popular notion of psychology.—To those who are ignorant of the true nature of the science, the word psychology suggests that which is mysterious, hidden, difficult to observe, even the spooky and supernatural. And because of this popular misconception of the subject, the majority of us as students approach the study of psychology either with dread of its abstractness or with light-hearted curiosity. This is unfortunate alike for the science and for the student, as it tends to cause courses to degenerate into utterly unsystematic and unscientific discussions of such interesting and bizarre phenomena as illusions, multiple personality, and spiritualistic communications. In so far as they are genuinely observable phenomena, all these are parts of the subject-matter of psychology and they may quite properly be examined in any systematic course, but they do not constitute the science, and it is a mistake to make them prominent.

How can psychology be defined?—Just because of the many and odd misapprehensions which are prevalent, it is urgently important that at the very beginning of our study of psychology we gain a clear working knowledge of the materials of the science, of its tasks or problems, of its methods, and of its values. It is easy to discover that no science can be defined satisfactorily except in terms of such knowledge.

In view of this fact, this text does not offer a conventional definition to start with, but instead Part One is devoted to the presentation of such facts concerning the characteristics of the subject as are absolutely necessary for formulating or understanding a good definition. The general knowledge of any science which every beginner should acquire in an introductory course should enable him to answer the questions: What is the subject-matter or material of the science? What does the scientist attempt to do with this material? How does he accomplish his tasks? What are the values of the results? Any one who can state clearly what psychology deals with, and how, and why, and to what purpose has already made an excellent start in the study of the science. Such a statement might reasonably be expected of any one who intelligently reads the introductory chapters of this book.

What is the subject-matter or material of psychology?—It is consciousness or the world of objects and events viewed as consciousness. But what is consciousness? It is our awareness of things and happenings as about us, within us, or of us. It is just what we constantly are talking of in terms of sensations, feelings, emotions, ideas, thoughts. In fact it is precisely what we mean to designate by such words. Up to this point each of us realizes what the word consciousness means, but how few of us know anything more about it. Inasmuch as the facts of consciousness are right at hand during the whole of our waking

lives, it would seem impossible that we should not become expert in observing their characteristics. Nevertheless, it is a fact that we do not. In the presence of infinite and convenient resources, so far as the facts of psychology are concerned, we are poverty stricken, for most of us simply do not know how to observe our sensations, feelings, or emotions. Millions of human beings—unfortunate but all unconscious of what they are missing—go through life blind to the psychological world. From the point of vantage of the skilled observer of consciousness this is quite as great a loss to the individual as is caused by ignorance of the world of the physical sciences. The least that any of us can do is to learn to observe psychological processes as accurately as we observe the processes of the world about us. This much we owe to ourselves as educated members of civilized races. We may have neither the desire nor the ability to become great observers in this field, but we can acquire that degree of skill which will render us intelligently appreciative of the facts and laws of mental life. *In this sense we should all be psychologists.*

The psychologist's point of view.—*Everything which comes within the awareness or consciousness of you or me or any other being is material for the science of psychology.* But at the same time it also is material for other sciences. The printed page before me which I am now studying as consciousness—my awareness of the page—I may, if I choose, study as an object of physics or of chemistry. And the dog which I am interested in just now as a psychological object, both because it is a part of my consciousness and because I regard it as possessing consciousness, may perfectly well be studied as material of anatomy or physiology. This clearly indicates that psychology differs from the sciences of physics, chemistry, and biology, and, indeed, from all of the subjects which are usually called natural sciences, in its point of view rather than in its objects.

Upon reflection, we discover that the whole world may be viewed either as consciousness or as objects and events existing apart from my consciousness. The physical and the biological scientists view their objects as existing "out there" and as relatively independent of the observer. The psychologist views the very same objects as bits of consciousness, and, therefore, as dependent upon the observer. The two points of view are equally legitimate and equally useful for science, for the first gives us a description of the world as physically existent, as objects and events about us; and the second gives us a description of the same world as consciousness or experience, as objects and events within us. The physical point of view is called objective; the psychological point of view is called subjective.

Some persons are objectively minded and others are subjectively minded.—In all of our bouts with the world we take either one or the other of these points of view or attitudes. The majority of observers shift frequently from the one to the other, and have no strong bent or prejudice in favor of either. Such individuals are neither objective observers nor subjective observers by natural inclination. For them the chemical formulæ which the chemist offers as descriptive of an orange or a butterfly are quite as interesting and valuable as the psychical descriptions of the same objects which are offered by the psychologist. But, on the other hand, there are persons who are by nature either objectivists or subjectivists. Typical of the former are those physical scientists who insist that only the objective attitude toward things, and the descriptions which the physical sciences give us, are worth while. This contention is neither liberal nor broad-minded, yet it is not less so than is that of those born subjectivists who can see value only in psychological accounts of the world. To the unprejudiced observer it seems fairly clear that both points of view are profitable, and that we therefore should study

things physically and psychically. The anatomist, the physiologist, and the chemist may describe the butterfly—theirs are purely objective accounts of the object—and so may the psychologist, but his is a subjective account of the same object. Who may rightfully decide that the physical or objective description of this fascinating object is more valuable than the account of it in terms of your sensations and feelings, emotions and sentiments, ideas and associations, thoughts and inferences, or of mine?

For our present purposes, it will suffice if we see clearly that the world may be studied scientifically in more than one way, and that the psychologist's way of viewing things is as worthy of serious consideration as is the physicist's, the chemist's, the anatomist's, or the physiologist's. A proper start in psychology demands that one appreciate the difference between the attitude of the physical observer and that of the psychical observer. Not until one can take the psychological point of view is one able to understand what psychology is striving to accomplish.

The scope of psychology.—The world as my consciousness is the subject-matter of psychology which is nearest at hand, and my start in the subject should be gained by careful observation of my own experiences. This is true for each of us. No one who is unable to observe the wonders of his own consciousness can really enter the kingdom of psychology. The characteristics of a sensation of red I may observe for myself, if I can take the psychological point of view or attitude, but it is utterly impossible for you to describe it so that I shall realize its richness of content. Each one of us must start in his study of consciousness by looking inward, by observing the self, or by introspecting as the psychologist says. In the light of my own experience in the study of psychology, I am convinced that one plods along laboriously and unprofitably until

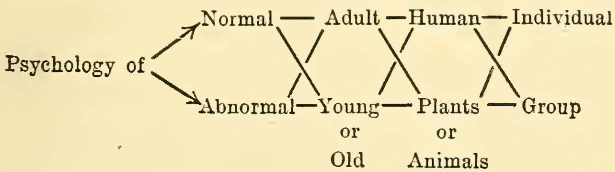
one learns how to introspect. Let us, therefore, attempt from the outset to observe what is going on in our own minds; let us question every statement of text-book or teacher until we succeed in verifying it by self-observation, for in so doing we shall rapidly and painlessly make psychologists of ourselves.

But the science of psychology is by no means limited to the investigation of your mental processes or of mine at this moment. It includes whatever may at any time be studied from the subjective point of view. Any observer may study as much of the world as his experience includes. He may investigate psychologically inanimate as well as animate objects; plants as well as animals; objects which are ordinarily described as unconscious and those which are generally described as conscious. Any and all of the products of human or of brute industry may be studied psychologically. Indeed it is a fact that works of art, instruments of the chase, and domestic implements are intensely interesting as materials of psychology. Toward the novel of a human genius or the text-book of psychology, I may take the psychological attitude, and I may describe both in terms of consciousness. And, further, I may distinguish the consciousness as mine or as that of the author of the book, for both the novel and the text-book are on the one hand my consciousness and on the other the expressions of another being's consciousness. Toward the chimpanzee or the dog, the sensitive plant or the amœba, I similarly may take the psychological attitude, and forthwith they become for me objects of psychology.

Again, it is true that I may describe these objects either as my consciousness or as conscious objects. This leads us to distinguish two classes of psychological objects: those which are merely *objects of consciousness* (e.g., the table, the book, the bar of steel), and those which are *conscious objects* (e.g., the child, the gorilla, the horse, the dog, the

squirrel, and whatsoever objects we admit to possess awareness). In so far as we deal psychologically with objects of consciousness, we are within the realm of the psychology of the self, for it is only as some observer becomes aware of these things that they take their place among the materials of psychology. But as we deal with conscious objects, we extend the psychology of the self until things are viewed as sharing the observer's awareness or as having something similar to it. Provisionally at least, we may profitably think of the material or subject-matter of our science as whatever comes within the stream of consciousness of a self-observing being.

The natural branches or divisions of psychology.—According to the nature or condition of the observer or of the object observed we divide the general science of consciousness into several branches. These are not mutually independent, and they serve merely for convenience of reference and description. We must first note that as the fundamental basis for psychology we have the results of the self-observation of the normal, adult, human individual. This is what we narrowly designate as psychology. Now, taking the four descriptive words, normal, adult, human, and individual, we are able to represent the chief branches of the science by the following diagram:



This scheme presents eight main divisions of the science, namely:

(1) Normal psychology, as contrasted with (2) Abnormal psychology;

(3) Adult psychology, as contrasted with (4) Child psychology or Senile psychology;

(5) Human psychology, as contrasted with (6) Plant or Animal psychology;

(7) Individual psychology, as contrasted with (8) Group or Collective psychology.

But there are evidently as many branches of the science as there are possible combinations of the four pairs of contrasted conditions named in the scheme. Of these sixteen branches, a few may be mentioned to make clear the way in which the combinations work out. There is, for example, the psychology of the normal, adult, human individual—the basis of the general science—and there is also the psychology of the abnormal, adult, human individual; the psychology of the normal, young or old, human individual; the psychology of the abnormal, adult, individual animal; and so on throughout the possible list of combinations.

It is to be observed that no sharp and unmistakable distinction exists between normal and abnormal. Nevertheless, it is useful to be able to refer to the psychology of normal consciousness and of abnormal consciousness. Likewise, the adult condition of the psychological object or observer is to be distinguished not from a single different condition but from a large number, for the psychology of infancy is different from that of childhood, and that in turn differs from the psychology of adolescence, of youth, of age, or senility. Indeed it is only quite arbitrarily that we can divide life into psychological periods. And in the case of human psychology, as contrasted with that of other beings, there are not two or even three kinds of psychology, but instead as many as there are types of living beings which possess awareness. Properly we should contrast human psychology not with plant and animal psychology but with rose and volvox, with amœba and stentor, with dog and chimpanzee psychology. Finally, in the case of

the contrast between the psychology of the individual and that of the group, we discover that there are many kinds of groups. There is a psychology of the family, the political party, the nation, the race. But all of these branches of the subject we ordinarily include in the division called social or collective psychology, just as we include the psychology of all creatures except man in plant and animal psychology.

Characteristics of the eight main divisions of psychology.—Each of these divisions is distinguished from all of the others primarily by its materials. Normal consciousness is not material for abnormal psychology, nor is the consciousness of the adult being material for child psychology. This ground of distinction is definitely useful, and no other is needed for the identification of the portion of the science with which one happens to be dealing. But there are certain differences in method which are significant. It is impossible to study abnormal consciousness in precisely the same way that normal consciousness is ordinarily studied. Again, we can not investigate the dog or even our human friend as a conscious object just as we investigate our own consciousness. This, however, is not an appropriate place for the discussion of the methods of psychology and the further consideration of this subject must be presented in the chapter on methods.

The early relations of psychology to other branches of knowledge.—In antiquity and throughout the middle ages psychology was closely related to, or regarded as a part of, philosophy. It grew up with philosophic systems, and most philosophers presented as a part of their systems theories of knowledge, together with more or less information concerning the facts of consciousness. Gradually, as facts accumulated, it tended to assume the place of an independent branch of philosophy. And even to-day in some quarters it is looked upon as a speculative and teleological subject, naturally allied to ontology and epistemol-

ogy, rather than as a causal science. As mute evidence of this we have the divisions of philosophy of many educational institutions, including psychology as well as ethics, metaphysics, logic, and the history of philosophy. Yet, in spite of this evidence to the contrary, we are forced to recognize that during the past hundred years a definite science of psychology has sprung up, as a result of careful and systematic observation of consciousness. During the last half century observation under experimental conditions has entirely changed the nature of the science by bringing it within the scope of strictly scientific method. Scarcely two generations ago the modern science of psychology was born, and to-day it is widely recognized as a science whose aims and methods are practically identical with those of the physical sciences.

The relation of psychology to the physical sciences.—We have already seen that psychology has to do with the same materials as the physical and the biological sciences, but that it studies its materials from a different point of view. It is therefore the point of view which serves to separate psychology, and indeed all the psychical or subjective sciences, from the physical or objective sciences. In practice the psychologist has much to learn from the physicist because precision in observation and skill in experimentation have been developed to a much higher degree in the physical than in the psychical sciences.

The relation of psychology to biology.—There is a strong tendency in the minds of physicists and biologists—if not of natural scientists generally—to regard psychology as one of the biological sciences. This is because it deals with something which appears in our experience to be associated invariably with living things. Is not consciousness a part of the life of the organism, and must we not study it as such? is the natural question asked by one who takes this view. This question is answered in strikingly different

ways. On the one hand, there are those who believe that psychology is merely a part of the physiology of the nervous system, and that it will cease to exist as a separate science as soon as we understand fully the processes which occur in the central nervous system, and especially in the brain. On the other hand, there are those who maintain that descriptions of bodily processes, whether they be brain processes or not, do not satisfy our demands for descriptions of the phenomena of consciousness. On the whole, the latter position seems the more satisfactory at present and we may therefore say that psychology is not, strictly speaking, a part of physiology. It is not even a biological science, for it approaches its materials from an entirely different point of view than that of biology.

Psychology and the functions of the brain.—It is the avowed business of physiology to study the functions of the living organism and of its parts or organs. It describes these functions in terms of energy, and, if it is consistent, never in any other terms. A physiological account of bodily processes which makes use of sensations, memory images, ideas, thoughts, or anything else psychological, is unsatisfactory because it fails to realize the ideal of physical science. Consciousness, however, is not energy, although it may prove to be a manifestation or accompaniment of certain energetic phenomena in the body. Hence it can not be described in physiological terms.

The fact is that as psychologists we view things as consciousness and it makes no essential difference to us whether the phenomena happen to be associated with a living organism or not. If to-morrow it should be proved beyond reasonable doubt that consciousness exists apart from living bodies, the discovery would in no way modify the conception of psychology which this book presents. But obviously for those who hold that psychology is simply one branch

of the physiology of the nervous system such a discovery would be revolutionary in its effects. However far we may carry our study of the changes which occur in the brain, or in any part of the living organism, there will remain unaltered save by the contributions of a subjective psychology, the demand for an account of consciousness as such.

Is neurology necessary for the study of consciousness? —Neurology is the science of the structures and functions of the nervous system. It is not infrequently claimed by biologists and by psychologists that the study of this subject is essential to the understanding of consciousness. The facts of mental life or consciousness can be explained, they tell us, only by referring them to changes in the body. As one result of this belief, we find that most text-books of psychology contain chapters on the structures and functions of the nervous system. Admitting, as we doubtless should, that a knowledge of bodily processes is helpful in the study of psychology, we may reasonably contend that a text-book of psychology is not the proper place for the presentation of neurological facts.

There are two serious objections to the mixing of psychological and biological materials in a course. The first, and by far the most important, is that the beginning student almost inevitably gets the notion that psychology is in part at least a study of the nervous system. The second is that the presentation of this non-psychological material which serves merely as an aid in the study of consciousness demands time which ought to be devoted to psychology itself. *If neurology, or any other branch of biology, is essential for the study of psychology, then the student should have studied the subject with specialists and experts in preparation for his work in psychology.* Certainly it is highly desirable that every student of psychology should have taken work in biology and should know something

about the nervous system and its significance. But he as certainly should not have to be given this information in his first course in psychology.

The most profitable attitude for the student of psychology would appear to be that of whole-hearted and enthusiastic attention to the characteristics of consciousness itself. His aim should be singly and consistently that of learning how to live in the psychological attitude toward objects. In reading this book he should strive to enter into the spirit of psychology, forgetting the fact that consciousness happens to be observed only in connection with living objects. He should endeavor, first of all, to learn the essential things about psychological as contrasted with physical phenomena or physiological phenomena; about the tasks which the science strives to fulfill, and about its methods. Once this knowledge of the subject has been acquired by a student, he is a psychologist, however ignorant he may be of technical neurology or of general biology, and he may then with keen insight and profit study the relations of mental to bodily phenomena.

The correlating of psychological and physiological facts.—From the foregoing it should not be inferred that the study of the relations of mind to body is less important than the study of either mind or body. The fact is that physiological psychology is a most interesting and important branch of scientific inquiry. Its proper task is the correlating of mental processes with bodily changes. From the very nature of its task, it is a connecting link between psychology and physiology. For pedagogical as well as for scientific reasons it is wiser to begin with the study of pure psychology or physiology, rather than with the science which connects them, if one wishes to gain a thoroughly scientific knowledge of mind, body, and their relations. It is the sole purpose of this book to aid beginning students in the study of pure psychology.

CLASS EXERCISE

Self-observation. The introspection of a train of (associated) ideas. Materials: paper and pen or pencil.

The instructor should prepare the class for this task by giving, from his own introspection or reading, an account of an associative consciousness.

When the class is ready to observe, the instructor should announce a word—college, flag, accident,—which shall serve as a starting-point and, after the expiration of thirty seconds, he should give the signal to begin writing an account of what has occurred in consciousness during the interval.

The value of this exercise depends largely upon the ability of the instructor to make clear to the class what is meant by a "train of ideas."

SUPPLEMENTARY READING

Ebbinghaus, H.: Psychology, "Introduction, a sketch of the history of psychology," pp. 3-25.
Titchener, E. B.: Text-book of psychology, §§ 1, 2, 7, and note p. 43.
Wundt, Wm.: Outlines of psychology. Third English edition, §§ 1, 2.

CHAPTER III

THE AIMS, TASKS, OR PROBLEMS OF PSYCHOLOGY

"My first concern as psychologist is the accurate analysis of my consciousness. For the purposes of this introspective analysis, I may seize upon any experience. I am looking out from my window, let us say, upon Gloucester harbor and the open sea beyond, happily conscious of wooded shores, rippling blue waves, cloudy horizon, white sails, and salty breeze; and the dory moored to the lichen-grown rock in the foreground has dimly suggested last evening's sail and the sunset light over the harbor. In this conscious experience, I at once recognize blueness, greenness, grayness, brownness, saltiness, and rippling sound as parts of the experience. Closer scrutiny will add to the list distance and form, motion (of the breeze), and further, the red, the gold, and the motor sensations which belong to the image of the sunset sail. Even now the analysis is far from complete; it has left out of account the pleasantness of the whole experience and the feeling of familiarity which accompanies the memory of the sail."—Calkins, M. W.: Introduction to psychology, p. 17.

What is the general aim of the natural sciences?—Preparatory to an examination of the aims of psychology, we may profitably seek to discover what the natural sciences attempt to do with their materials. Let us take chemistry as a typical natural science. We note, first, that it is the systematic study of certain kinds of objects and processes. This study is carried on by means of observation and experiment, and by these means the chemist aims (1) to describe the things which he observes, so that they may be distinguished from one another and from other kinds of objects; (2) to discover the principles and laws according to which chemical changes occur; and (3) to explain what he sees by giving causes for every occurrence. The astronomer, the geologist, the physicist, the anatomist, the physiologist—in fact, every natural scientist—attempts to

do just what the chemist does. Each of them, in his special field, describes his objects, formulates laws, and offers explanations.

Psychology has the same general aim as natural science.—The psychologist, from a different point of view, seeks the same sort of information about his objects as do natural scientists. First he strives to describe psychological objects and events; next he states psychological principles and laws; and finally, he explains what he observes by stating the conditions of events. Although the procedure is somewhat artificial, we may, for the sake of clearness, divide the aims of psychology into five groups of tasks. These several tasks may conveniently be designated by the words, (1) Description; (2) Genetic description or History; (3) Generalization; (4) Explanation and correlation; and (5) Control. Each of these special aims will now be described more fully.

Description: the first task of psychology is to discover the constitution of consciousness.—By procedures which are called analysis and synthesis the chemist discovers the constitution or composition of the substance which he is studying. The anatomist does precisely the same thing when he disarticulates the bones of the skull in such fashion that he has before him each constituent bony element of the object, and then, by reversing the process, replaces the parts in their proper relations so that they assume the shape of the original skull. Similarly the psychologist by the process of analysis discovers the constituent elements or parts of such psychical objects as ideas or emotions, and notes the way in which these parts are related to one another. What the molecule, the atom, and the ion are to the chemist, the products of analysis—sensations, images, affections—are to the psychologist.

Analysis and synthesis are mutually supplementary methods of discovering the constitution of objects. If

the chemist or the anatomist, after breaking up an object into its simple parts, is unable to build up the same kind of object by re-combining the parts, he lacks certain essential knowledge. Analysis usually precedes synthesis, but it is not more important. The analysis of consciousness, and the verification of the results of analysis by synthesis, would seem to be the initial task of the psychologist. It is this task which should yield us what may be called the anatomy of consciousness.

Analysis and synthesis make possible the description of consciousness.—It is only in terms of the more or less simple parts or qualities of objects that we can describe them. Analysis and synthesis, then, are to be looked upon as means of obtaining the materials which are needed for description. The anatomist may, after a rather superficial examination of a skull, describe it by enumerating the various bones which enter into its composition. Again, he may continue his analysis, for descriptive purposes, by breaking up each bone into its constituent parts; and even these, in turn may prove to be still further analyzable. Ultimately he may describe the skull in terms of cells instead of bones. Having reached a point beyond which his powers of observation do not enable him to go, he states that he has discovered the simple or elemental constituents of the object.

Now, the psychologist does exactly the same thing with the materials of his science. Starting with a complex object called an emotion, he first breaks it up into groups of sensations and feelings, into ideas and images. These, for the time, he regards as the constituent parts of the object. But upon further careful examination, some or all of the parts may prove to be complex and therefore further analyzable. Thus the process of seeking for the elementary parts of things is continued until science can go no further. We have no right, however, to insist at any time that

a science has reached the farthest point in analysis, for at any moment some physicist, chemist, physiologist, or psychologist may discover a way of breaking up what is at this moment regarded as an elemental or simple object. It is quite certain that psychology has not completed its analysis of consciousness.

Description in psychology involves more than the mere enumeration of parts.—Analysis and synthesis reveal the relations in which the parts of an object stand, as well as the parts themselves. It is well known that the same chemical atoms placed in slightly different relations constitute utterly different molecules, and these, in turn, distinguishable substances. Likewise in psychology, the sensations, or other fragments of consciousness, which in one arrangement give us an object with which we are perfectly familiar, may, in a somewhat different arrangement, constitute an object which is wholly new to us. Strictly speaking, the relations of parts are not themselves elements of an object, but they are essential in our description of the object. For it is clear that we can not properly describe anything without taking into account both constituent parts and their particular relations. And so it comes about that in psychology, no less than in the physical and the biological sciences, analysis and synthesis are constantly being employed to reveal the various ways in which a group of elements or parts may be combined. The task of describing objects is never ideally completed in any subject, for the reason that we may always hope to be able to go beyond what other observers have attained. This it is that spurs scientists to persistent analytic and synthetic study of their objects.

Genetic description or history: the second task of psychology.—There are two kinds of description in psychology as well as in the natural sciences. The one is simple description of an object as it happens to exist for

the observer at the moment. Examples of this kind of description are the chemist's account of a new salt which he has analyzed into three known elements; the anatomist's description of a skull in terms of its constituent bones; or the psychologist's description of an idea in terms of images. The other is genetic description. This differs from simple description in that it takes account of the history of the object in question, and aims to give an account of the developmental changes through which it has passed in process of becoming what it is. The developmental or evolutionary descriptions of the chemical elements, of living beings, of human institutions, and of consciousness are genetic. Each of these descriptions presents a more or less complete history of some object.

As it happens, this is an era of genetic description and we are prone to lose sight of the value of simple descriptions of things in our enthusiasm for accounts of the ways in which they came to be what they are. It is especially desirable that we realize the fundamental importance of simple description in psychology, for the starting point and the basis for all studies in the history of mind should be a thorough knowledge of the present condition of the object. We may with profit seek to discover the history of mind, to trace its development through the ages in species after species and from race to race, or in the individual from birth to death, to reveal the progress from the simpler to the more complex forms of psychological objects in the growth of consciousness, but we must not forget that we are trying to describe a present object. In this book it will be well for us to separate these two kinds of description rather sharply by presenting their respective results in separate parts.

Generalization: the third task of psychology is to discover principles and laws.—It has been stated in the foregoing paragraphs that psychology, in common with

the natural sciences, strives by analysis and synthesis of its objects to obtain accurate descriptions of them in terms of their constituent elements and the relations of these elements or parts. But science does not rest satisfied with the particular facts which are thus obtained. It seeks always wider and wider knowledge of objects and events. One of its most prominent aims is to discover common elements, properties, or relations in objects so that a general statement shall be made to cover or include a number of particular facts. This means simply that facts are described as groups instead of individually. Obviously, science makes a great step forward when it succeeds in describing the class of objects called frogs. For henceforth, without the labor of describing every particular object of the class, it offers us a formula by means of which we can distinguish a frog from every other living thing.

All sciences seek general statements. By a process which is known as generalization particular observations are brought under a single statement of fact. When these generalizations are of such a nature as to permit us to predict certain events from the presence of certain others, we call them scientific laws. The laws of a science are its chief value and pride. Indeed, not until the investigation of a group of objects has enabled observers to formulate a number of important laws are the results accepted as together constituting a science.

A law can not be seen.—Unlike the elements and relations of objects, principles and laws can not be directly observed. They must be discovered by the comparison of a number of particular observations. The law of the conservation of energy, and the laws of motion were not discovered by observation. What was observed, and what we are continually observing, are particular expressions of these laws. The law itself can not be seen: it must arise

as a generalization in the mind of the observer. Once the observing scientist has succeeded in bringing particular observations together so that he can make a general statement regarding them, he is able to see the law exemplified in every particular happening. Almost all of us have the ability to observe events, but surprisingly few of us can discover principles or laws.

Each of the natural sciences has its body of laws—physical or biological as the case may be—and each science describes objects or predicts events, prior to the direct observation thereof, in the light of its generalizations. Although psychology is not less keen and persistent in its efforts to derive general statements from particular observations and to formulate laws than are the natural sciences, it is true that most students of the science are ignorant of psychological laws. Repeatedly I have discovered that the only psychological law which a student who had faithfully read some standard text-book of psychology could mention was Weber's law of the relation of stimulus to sensation. And that, unfortunately, is not, strictly speaking, a psychological law! Now the truth is that psychology has a respectable body of generalizations and laws. The prevalent ignorance thereof is doubtless due in large part to the fact that they usually are not labeled as such and therefore are not recognized by most elementary students of the science.

We can not too strongly emphasize the fact that psychology is precisely like the natural sciences with respect to the high esteem in which it holds the discovery of laws. A special part of this book is devoted to the discussion of generalizations and laws in order that the reader may be impressed by the fact that our science has already in part fulfilled this task.

The tasks of psychology are closely related.—Already we have noted that description, whether it be simple or

genetic, is dependent upon analysis and synthesis for its terms. We now must note that similarly generalization is impossible except in the light of descriptions of objects and events. The fact is that whenever we observe consciousness scientifically we analyze and synthesize in order that we may describe, generalize, and explain. The several tasks are quite inseparable, and in seeking to further one we may quite unexpectedly make important contributions to another.

Explanation: the fourth task is explanation of psychological phenomena.—In everyday life, as well as in science, we are constantly trying to give causes for, that is, to explain, what we observe. Rain is caused by the condensation of moisture in the air, under certain conditions; electricity is generated by friction; illness is caused by the action of certain injurious substances. These are typical examples of cause and effect. We have the habit of asking for causes, and most of us are not content until we have discovered some reason, some cause, some explanation for an occurrence which we have observed.

The chief difference between science and common sense in this search for causes which will serve to explain things is that science is more careful, critical, and consistent than is common sense. Many of the reasons which are given for natural events are not causes at all, for the statements rest upon careless or insufficient observation. Extreme examples of this kind of popular explanation are our prevalent superstitions. "See a pin and pick it up, All the day you'll have good luck." "To allow a child to look into a mirror before it is a month old will cause it to have trouble in teething." "To thank a person for combing your hair will cause baldness." "If one kills a frog his cow will go dry." Such are samples of the thousands of false explanations of events which are accepted more or less widely and quite unscientifically.

Science seeks the causes or conditions of events in order to explain them.—Science seeks causes systematically, persistently, critically. Observations have to be repeated scores, hundreds, even thousands of times under the same and under definitely varied conditions before the reliable scientist can satisfy himself that he has discovered the proper explanation of an event. Even then he is not likely to be dogmatic in stating his results.

The fact that the natural sciences explain occurrences in terms of cause and effect is unquestioned. Chemistry, physics, and biology are obviously causal sciences. Indeed their chief value seems to depend upon their ability to explain the phenomena with which they are concerned. But it is quite different with psychology, for many persons insist that this science explains its events teleologically, that is by stating purposes, instead of causally. Evidently this is a fundamentally important matter.

Is psychology a causal or a teleological science?—It has been shown in the foregoing chapter that psychology differs from the natural sciences not in the nature of its objects but in its point of view or attitude toward its materials. In the present chapter, it has thus far been shown that its tasks or aims are also identical with those of the natural sciences. In description and in generalization it seeks the kind of knowledge of its objects that is sought by physics and by biology. The question confronting us is, Does psychology also seek to explain its objects causally as do the natural sciences? Of the fact that it seeks explanations there can be no doubt. Are its explanations teleological or causal; are they purposes or conditions? We must answer this question, at least provisionally, before we can proceed.

A cause in physical science is an event which always precedes a given phenomenon. If every time the temperature rises, the column of mercury in a thermometer is ob-

served to rise, we conclude that there is a causal relation existing between these events. What we really observe is a definite sequence of events. The one seems necessarily to go before the other. Precisely this aspect of things which we observe in natural science we call physical causation.

Do we not observe similar sequences of events in psychology, and are we not justified in speaking of them as indicative of psychical causation? It is the writer's belief that we do observe psychical causes, and that psychology is a causal science. Under certain describable conditions I experience a visual sensation called white, which under given conditions is uniformly followed by another sensation called the after-image. The relation of these two psychological events fulfills exactly the requirements of the causal relation in natural science, and we may therefore designate the original visual sensation as a cause or condition of the after-image. It is to be noted that the conditions must be constant, in psychology as in physics, if the causal relation is to be maintained.

In the realm of physical things there exists physical causation; in the realm of psychological things there exists psychical causation. Common to these two kinds of causal explanation is the fact that observation reveals to us merely a definite sequence of events. Whenever one occurrence always precedes another in our experience we call the first the cause, the second the effect. There is no obvious reason why this procedure should not be used in psychology as well as in the natural sciences. Just as one change in my organism may be regarded as the cause of another, so one conscious process may be regarded as the cause of a process which is observed to follow it uniformly.

Psychology is eager for causes.—All of the descriptions and generalizations of psychology are pressed into the service of explanation. Explanation in truth is the chief function of science because it enables us to predict events.

Given the knowledge of a certain cause, we may prepare for its effect or effects. This ability to anticipate events and to prepare for them is of obvious practical importance to us in everyday life. By some scientists it is maintained to be the real justification for research. For our present purposes it is sufficient to realize that psychology seeks above all else explanations of its occurrences, that it may offer causes or state the conditions of an occurrence just as do the natural sciences.

Closely related to explanation in psychology is the task of correlation.—From the point of view of this book, this task is psycho-physical rather than psychological, for it involves efforts to discover the relations existing between bodily processes and consciousness. There are three theoretical views concerning the relation of body and mind which are worth considering briefly at this point. The first is that neither is the cause of anything that happens to the other. This is psycho-physical parallelism. The second is that bodily events cause certain conscious phenomena. And the third is that body and mind act on one another, sometimes the one, sometimes the other being the cause or source of causes. The most widely accepted of these hypotheses is that of psycho-physical parallelism.

Consciousness can not be explained causally by brain processes.—On the basis of the theory of psycho-physical parallelism, it is evident that bodily events can not be used as causal explanations of psychological occurrences. The best we can do in the way of relating body and mind is to correlate the two series of phenomena and to offer our correlations as explanations. All psychologists and physiologists to-day accept the task of correlating the processes of body and mind as important, and many of them work at it diligently without assuming that either kind of process is the cause of the other. Evidently a process or event in

consciousness which is found to occur always in connection with a certain process in the brain may be said to be explained in terms of the latter. Perhaps it would be even truer to say that when two processes, the one physiological (in the brain) and the other psychological (in consciousness) occur together uniformly either may be offered by science as an explanation of the other. But it is important to emphasize the fact that such an explanation is not causal. We have no satisfactory reason at present for believing that consciousness can be explained in terms of bodily processes, and it therefore seems wiser to hold consistently to the position which was stated in Chapter II of this book. This would force us to regard body and mind as the same complex of phenomena viewed differently. Naturally this precludes the explanation of either in terms of the other. For precisely this reason we should maintain that psychology explains its events causally just as does physiology or any other natural science, and, further, that the correlating of bodily and mental processes is, strictly speaking, neither a physiological nor a psychological task but instead a psycho-physical task.

The fifth, and last, task of psychology is the control of mental life.—As will be pointed out more clearly in Chapter V, the prediction, modification, and direction of psychological processes is an unescapable task of psychology. Simple and genetic descriptions, generalizations, explanations, and correlations all contribute to the fulfillment of this great practical aim of the science. Knowledge can not profitably be divorced from action. Hence, whatever we learn about the nature of psychological objects and events serves to influence our acts. As yet we are far from knowing how to guide mental development, but it is from psychology that we must expect the facts and principles which will ultimately render this possible and practicable.

The general aims of our science may be summarized as follows.—Psychology attempts to fulfill five important tasks. It aims (1) so to describe its objects that they may be identified readily and with exactitude, (2) to state their histories or to describe their course of development so that their different stages may be identified, (3) to formulate general statements, principles, and laws, (4) to explain its phenomena by indicating their causes and by correlating mental processes with bodily processes, and (5) to guide, direct, and control psychological events in the light of such knowledge of their characteristics, principles, and causes of occurrence as the methods of analysis and synthesis reveal.

Again, these closely related tasks may be described somewhat differently thus. Psychology first analyzes its materials into their simple parts in order to discover the structure or constitution of consciousness. Then, by recombining the products of analysis, it tests and verifies its analyses. Together analysis and synthesis furnish the facts which enable the psychologist to describe his objects. Comparison of different conditions of mind yield those data from which the genetic description or history of consciousness is derived. With a thoroughgoing description of particular phenomena in hand, the psychologist seeks to formulate general statements which shall apply to wider and wider ranges of facts. Such generalizations, when they cover a definitely definable group of phenomena and enable us to predict certain events, are called principles or laws. Constantly in his efforts to fulfill the foregoing tasks the student of psychology is on the lookout for causes of events. Partly in terms of these causes and partly by stating the correlation between mental happenings and processes in the body he explains conscious processes. And, finally, he brings all of his knowledge to bear upon the problem of controlling mental life wisely and for the welfare of the race.

CLASS EXERCISE

Self-observation. Introspection of a memory of childhood. Materials: paper and pen or pencil.

Observe carefully, and write a detailed and accurate description of your memory (consciousness) of some event in your childhood which you vividly recall.

Upon the completion of the task, the reading of their introspective descriptions by two or three members of the class will furnish an excellent basis for the discussion of ways in which we recall events. The purpose of this exercise is to help each student to discover the way in which mind works when we are remembering.

SUPPLEMENTARY READING

Titchener, E. B.: Text-book of psychology, §§ 3, 4, 5, and 9.
Calkins, M. W.: First book in psychology, chap. I.
Stout, G. F.: Groundwork of psychology, pp. 11-17.

CHAPTER IV

THE METHODS OF PSYCHOLOGY

"One can not be too nice or too careful in experimenting on mind. There is no such thing as over-refinement of method. . . . The more delicately one analyzes, the more subtle does the mental process reveal itself to be."—TITCHENER, E. B.: The problems of experimental psychology. *American Journal of Psychology*, vol. 16, p. 222. 1905.

"It does not appear always to be understood that to teach psychology one must make the student psychologize."—WHIPPLE, G. M.: The teaching of psychology in normal schools. *Psychological Monographs*, vol. 12, no. 4, p. 25. 1910.

The characteristics of scientific method.—Scientific method involves two things: the systematic observation of phenomena, and the examination or control of circumstances so that the observation may be repeated. It is often said that the scientist observes and experiments. The statement is misleading, for experimentation really means observation under definitely controlled conditions. It is therefore truer to say that he observes under ordinary or natural and under experimentally controlled conditions. The usual scientific procedure is something like this. The observer attends to a certain object or event; he concentrates his power of observation upon some particular aspect of the object or event and studies it carefully and persistently; he repeats his observations under the same circumstances, if possible, in order to verify his former result; he varies the conditions, or experiments with his object, in order to study the matter in different ways; and, finally, he reports his observations as facts and they become a part of science. The key-notes of scientific method are careful observation and accurate description of the circumstances or conditions

under which the observation is made. Observations under experimental conditions are usually more satisfactory than those under natural conditions because they can be more readily and more accurately described.

The work of the scientific observer differs from that of the unscientific person in that it is more critical, painstaking, circumspect, and more frequently repeated for purposes of verification. The contrast between popular and scientific methods of observation nowhere appears more strikingly than in accounts of animal behavior. The casual observer seeing a dog several times avoid food which had been placed in a yellow dish, while eating greedily what it found in red and blue dishes forthwith concludes that the animal notices the color of the dishes and for some reason stays away from the yellow one. He does not stop to ask whether there may not be other reasons for the avoidance of the yellow dish; nor does he question the ability of the dog to see colors. The scientist, who had observed the same behavior, would hesitate to express a like conclusion unless he had succeeded in verifying the fact of color discrimination under conditions which enabled him to make sure that the dog was not influenced by some other factor than color. Thorough study of the behavior of the dog might prove that it disliked the food in the yellow dish, or that it preferred to go to those dishes which were darker than the yellow, or even that it was wholly incapable of distinguishing one color from another. A surprisingly large number of the statements which we make on the basis of fairly accurate casual observation prove, upon more searching study, to be either wholly or partially untrue.

The characteristics of psychological method.—Apparently there is nothing unique about the general method of psychology. It practices observation as do the natural sciences, and, as we have already seen, with the same aims. It even makes use of experimentation to such an

extent that the majority of its observations are now made under experimentally controlled instead of under natural conditions. To the extent to which it lives up to its scientific ideal, it is critical, painstaking, and rigorous in the verification of observations. To be sure, the natural scientists look outward as they study the objects of their sciences, whereas the psychologist, just because he is dealing with objects which exist as consciousness, necessarily looks self-ward. But there is another respect in which the psychical sciences differ from the natural sciences. They are less exact in method. It is fair at present to say that psychology is qualitative rather than quantitative, and that just the opposite is true of physics and chemistry. This does not mean, however, that psychology is not a quantitative science. It means, instead, that it has not yet reached a highly exact or quantitative state of development.

Introspection.—The name by which the self-ward looking of the psychologist is designated is introspection. In so far as it tends sharply to contrast physical with psychological methods of observation this special term is unfortunate, for as a matter of fact there are no fundamental differences in the methods of the two groups of sciences. But the word is convenient in that it constantly reminds us that we must seek psychological facts by examining our own experience. No one can give me as valuable a psychological description of the hills which I see from my office window as I can obtain by introspecting. The very word introspection suggests that the heart or basis of the science of psychology is the psychology of the self, of you, of me, and of every other being capable of self-observation. Indeed, self-observation is synonymous with introspection. It is by observing my own consciousness that I directly study the objects of consciousness. But as in the natural sciences we study objects now directly, and now indirectly with the

aid of physical instruments such as the microscope, the telescope, the radiometer, or the hygrometer, so in psychology we observe at times directly and without special aids, and again less directly in connection with instruments of research.

There are two types of psychological objects for introspection.—For the purposes of psychological description we separate objects into two large classes: those which are conscious, and those which are objects of consciousness. To the first class belong all objects which we recognize as either conscious or self-conscious; here we place plants, animals, and human selves. To the second class belong those objects to which we do not attribute consciousness: the things of the inorganic world and all lifeless objects. Again, the first class of objects of psychology is subdivided into those beings who are self-conscious, and those who are merely conscious. The former are capable of introspection to a greater or less extent, and the latter are incapable of distinguishing self from other objects. Now it is evident that the materials of psychology consist in varying proportions of objects of consciousness and of conscious objects. Any self-observing being can study the crystal as an object of consciousness or his closest human friend as a conscious object.

Why and how do we recognize certain objects as conscious?—It is important to notice that whether I gain my knowledge of the landscape directly or whether you describe it to me, it is only by introspecting that I learn anything about the matter as psychology. For even your words and gestures are merely objects of consciousness. They are not psychological facts and they can not directly give me a psychological account of any object or event. Nevertheless, I recognize that what you say and do has for me a psychological value quite different from that of the behavior of a musical toy. I acknowledge that you are a

conscious, or even an introspectively conscious, object, whereas I hold that the toy is simply an object of my consciousness. This distinction is commonplace enough, yet it profoundly influences the scientific procedure of the psychologist. The self, apparently, is the only object which I can view clearly and persistently both as a physical and as a psychological object. By studying it I discover that certain psychological facts are identical with certain physical facts. This leads me to translate one kind of fact into the other whenever I have need of so doing. Whenever I observe a certain physical object or event which self-observation has taught me to identify with a certain psychological object or event, I immediately translate it into precisely those psychological terms. This procedure is often described as inference on the basis of analogy. What I really do is to infer that since a certain physical object is equivalent to a certain psychical object in my immediate experience of my self it must be equivalent to the same psychical object wherever it is observed. Consequently, when I observe you to act under the stress of an awkward situation as I should act when I am frightened, I at once infer that as a conscious object you are experiencing fright. And in precisely the same manner we infer that other physical objects than human beings are or are not conscious or that they are conscious in particular ways because they look or act, write or speak as we should when conscious of certain objects or events. The introspective method soon leads those who employ it to the use of inference. Indeed, for the study of conscious objects as contrasted with objects of consciousness, it is indispensable.

We are wont to say that the varied products of civilization and culture are materials of psychology. Of course this is true. But these objects are peculiarly valuable psychologically, as compared with natural objects, because we interpret them in terms of the consciousness of the

beings who created them. The hieroglyphic, the tomahawk, the painting, the novel, are psychological objects which we describe as objects of consciousness that are also expressions of consciousness. It happens that our consciousness of such objects is very different from that of objects of non-human origin. Every object which is studied psychologically is interpreted in terms of consciousness. The earthworm no less than the lyric poem has its place among the materials of psychology. Each can be observed introspectively by any self-conscious being and the earthworm may be described either as an object of the consciousness of that individual or as that plus its own consciousness.

Other selves as psychological objects.—Every self has its peculiarities from the psychologist's point of view. The man is not like the ape, nor is the ape like the pond-lily. Yet one thing all objects have in common, they are objects for psychology only as they are introspected. The fact is, we find a much greater wealth of psychological detail in a fellow-being than in a stick, or stone, or even in a chimpanzee. But search as we may for some radical difference in these objects, we find nothing which enables us to study the one and to ignore the other. Each object is a complex of psychological phenomena for psychological study. It is both misleading and confusing for us to deal with human behavior as though it possessed entirely different psychological significance from that of the behavior of the cat, the frog, or the plant. What you do in response to my assertion that you are stupid may have more psychological value for me than what the mouse does when it is stimulated electrically. But toward your verbal account of your experience in avoiding some danger I must take the same attitude that I assume toward the behavior of the mouse when it avoids an electric shock by choosing to enter the lighter instead of the darker of two tunnels. Your words are no more directly material of psychology than is the

act of the mouse. Introspection deals with both as bits of consciousness.

It is a common error to maintain that another human being can introspect for us, while a dog, or mouse, or monkey can not. Between the procedure of the animal psychologist who observes the activities of a monkey and that of the human psychologist who permits some person to introspect for him, there is no difference, except that it is easier to interpret psychologically the behavior of the man than that of the monkey. All objective occurrences may be viewed psychologically: the human voice, gesture, writing activity are neither more nor less capable of being studied psychologically than any other occurrences. The human scream of horror and the frightened rabbit's cry are equally psychological, but neither is describable in terms of consciousness until it is introspected. Thus we may sweep away the utterly artificial barrier which is often set up between human and animal psychology. Much more profitably we might speak of the different psychological values of objects which are merely objects of consciousness, and of those which inference leads us to study as conscious or self-conscious objects.

Different ways of using the introspective method.— Introspection is really a special name for psychological observation. It has been said that observation is of two kinds: natural and experimental. More fully stated this means that any object—whether physical or psychical— may be observed just as one happens to find it, or under conditions which have been artificially arranged to suit the purposes of observation. The former is usually spoken of as observation under natural conditions or as "naturalistic," and the latter, as observation under experimental conditions or as "experimental." No thoroughly trained scientist in practice restricts himself to the use of either of these methods. The physicist who never experimented

would be as unprofitable to society as the psychologist who never introspected except under experimental conditions. History furnishes us with an admirable illustration of the results of limiting one's self to the method of observation under natural conditions in the work of the " naturalistic " students of animal behavior and psychology. Their work is interesting, entertaining, of recognized scientific value, but it has not developed a science of behavior.

In psychology, as in every science, facts are often observed under quite informal and uncontrolled conditions; their discovery frequently is unpremediated by the observer. But they are nevertheless valuable. For example, as I am walking leisurely through the woods I chance to see a raccoon washing something carefully in a stream. This serves to whet my curiosity, and I frequent regions which are inhabited by raccoons day after day with the hope of being able to settle finally the mooted question as to whether this animal regularly washes its food before eating it. Perhaps my patience gives out before I happen to get another opportunity to repeat my observation. In this event, I have made little progress. Or perhaps I am fortunate enough to witness several performances similar to the first. Evidently this would enable me to call my observation scientific, provided I had observed carefully and critically under favorable circumstances. But just there is the rub. It is extremely difficult, as a rule, to happen upon favorable circumstances for the observation of a particular phenomenon in nature. The person who is truly and liberally scientific in spirit would inevitably attempt to observe the behavior of the raccoon under experimental conditions, not only for the sake of verifying the observation under definitely describable conditions, but also in order to repeat the observation almost at will. This in fact is the great merit of experimentation, it enables the observer to repeat his examination of the object until

he is certain of his facts, and it also enables him to describe exactly the conditions of observation. By capturing a number of raccoons and confining them in a restricted but reasonably normal habitat so that the conditions of observation were under satisfactory experimental control, I might learn more in a single day of careful observation than I could by roaming the woods for weeks. For however reluctantly we may admit it, objects do not bend all their energies toward aiding us in our studies of them. And of all objects, wild animals would seem to aid us least. It is far from true, however, that the naturalistic method is useless. It should always be used to supplement or complement experimentation.

The experimental method in psychology.—Observation under experimental conditions in psychology has been practiced commonly for about fifty years. It simply means that the experimenter chooses or controls the circumstances in which he studies consciousness so that he can describe them accurately and reëstablish them subsequently in case he wishes to repeat the observations. Suppose a psychologist wishes to observe a sensation of cold. He may set about it by concentrating his attention introspectively upon the experience which comes to him whenever a cold object happens to come in contact with the skin of his body. This would be naturalistic observation because no attempt had been made to observe the sensation under controlled conditions. Or the observer might so arrange conditions that a particular point on the surface of the body could be touched in exactly the same way time after time by an object of a certain constant known temperature. This too would enable the individual to introspect the cold sensation repeatedly. But unlike the former method, it would enable him so to describe his work that any other experimenter could readily repeat it and thus verify or correct the first observer's results. An ideal experiment in any

science is one which can be repeated with extreme precision of measurement in both conditions and results.

Many persons have the impression that experimentation necessarily involves observation under uncomfortable or highly unnatural conditions. This is not necessarily the case. An experiment may be performed anywhere and at any time provided the observer has arranged describable and controllable conditions. The skill of a psychologist is to be measured by his success in avoiding unnatural and uncomfortable conditions, as well as by the degree of accuracy of his descriptions. Progress in psychology undoubtedly depends in large measure upon the development of precise methods of experimentation.

CLASS EXERCISE

Self-observation. Introspection of some skin sensations. Materials: paper and a nicely sharpened pencil whose point is not too fine.

Allow the pencil to rest with its full weight upon the skin of the back of the hand. Carefully observe the sensation. Raise the pencil carefully and allow it to touch in succession several points on the hand. Are the sensations alike? In what respects do they differ? Now, draw the pencil slowly across the back of the hand, observing the changes in sensation, if any occur. How many kinds of skin sensation has this simple experiment revealed? Write a full account of your introspection.

The instructor may profitably perform this experiment with the class and thus, by acting as a model experimenter, enable students to avoid mistakes in method. The written reports may be delivered to a member of the class as the basis, in connection with special reading, for a general report on cutaneous sensations.

SUPPLEMENTARY READING

Titchener, E. B.: Text-book of psychology, § 6.
Titchener, E. B.: Outline of psychology, §§ 9 and 10.
Wundt, Wm.: Outlines of psychology, § 3.
Myers, C. S.: Experimental psychology, pp. 1-10.

CHAPTER V

THE VALUES AND IDEALS OF PSYCHOLOGY

"The importance of submitting our faculties to measurement lies in the curious unconsciousness in which we are apt to live of our personal peculiarities, and which our intimate friends often fail to remark. I have spoken of the ignorance of elderly persons of their deafness to high notes, but even the existence of such a peculiarity as color blindness was not suspected until the memoir of Dalton in 1794. That one person out of twenty-nine or thereabouts should be unable to distinguish a red from a green, without knowing that he had any deficiency in color sense, and without betraying his deficiency to his friends, seems perfectly incredible to the other twenty-eight; yet as a matter of fact he rarely does either the one or the other."—GALTON, FRANCIS: Inquiries into human faculty. Everyman's Library Edition, p. 31.

Why does science exist?—There are at least two fairly obvious reasons for the systematic study of things which is called science. The one is man's desire for information, knowledge, understanding, or learning, and the other is his intense interest in the application of information to the problems of life. According as the one or the other of these interests or desires predominates in our study of things, we are said to work in pure science or in applied science. A few scientific investigators are devoted solely and with rare disinterestedness to the increase of human knowledge. They consistently assure those who upbraid them for wasting their time in a profitless quest of learning that they love truth for its own sake and not because of any commercial value which it may possess. On the other hand there are a few investigators whose interest centers about the practical applications of scientifically established facts. For them knowledge means increased possibility of progress

in industry and art. Fortunately, however, not all scientists belong to these two groups. There are investigators —and to them civilization owes its heaviest debt—who are neither pure nor applied scientists because they combine the interests of both.

Science as the hoarding of information.—He who questions nature and masters the knowledge of the ages with no other aim or desire than the satisfaction of his own curiosity and longing is little better than the miserly hoarder of money or of other forms of wealth. But to just this type of scientist we owe a striking emphasis of the fact that pure science justifies its existence in the measure in which it contributes to the welfare of mankind. Those disinterested investigators who pay no heed to the practical uses of the facts which they discover are worthy representatives of science only if they realize that theirs is the most serviceable attitude. For the truth is that should they limit their quest to those facts which are demanded by some particular need in art or in industry the development of knowledge would be delayed and most seriously distorted. Should they stop to ask at every turn of the way, What value can this investigation have for society? they would defeat their own ends. The genuinely disinterested and wise student of science has a large faith in the value of knowledge, and he realizes that it is only by slowly and laboriously gathering fragments of information that he can do his share toward preparing for great practical discoveries. Repeatedly during the development of modern science, it has been shown that what to-day seems utterly unimportant, even to the scientist who is keen for practical applications, may to-morrow loom up as a necessary step toward the greatest discovery of the age. This clearly points the moral that as scientists we should be neither miserly hoarders of information nor selfish seekers of material wealth.

Science as the search for useful knowledge.—There are those who believe that science exists because of its immediate value for man. This seems like a grossly utilitarian view, but it doubtless contains important truth. Man has not been slow to recognize that the sort of knowledge for which science strives enables him to predict and prepare for events. Yet even now less credit is given to science by most of us than is deserved. Look where we will, we discover that systematic investigation has taught us what to expect of our environment and has helped us to adapt ourselves to the conditions of life. When we consider the recent discoveries of the sciences of bacteriology and pathology, we are forced to admit that the information which they have given concerning the relations of bacteria to man, the conditions of health, and the use of natural agencies for the control of disease daily brings us nearer to that perfect control of the conditions of life which is essential to our welfare. The brutes live comfortably or miserably according to the accidents of their immediate surroundings; they are helpless in the face of unfavorable conditions. But man has taken into his own hands the control of many of the conditions of his life, and these he attempts to manipulate to his satisfaction.

Innumerable examples of circumstances whose significance it is important for us to foresee might be given, but a few will suffice. What does it mean to us to foresee that a certain untoward event is likely to result in hydrophobia, and at the same time to predict the prevention of this dread development by a certain course of treatment? What does it mean to us to foresee, to prepare for or to prevent, the occurrence of accidents, diseases, destruction of property? To predict the appearance of earthquakes, cyclones, tidal waves, explosions, harmful or prized substances is eminently worth while, but as yet science has not accumulated enough knowledge of the conditions of these events

to make this possible. This proves simply that we are at the beginning of our study of nature. With that adequate knowledge of animate and inanimate things which is the goal of science in our possession we shall no longer stumble along half blindly in the world, but instead we shall wisely adjust environment to ourselves and ourselves to environment.

Has psychology the same values as science in general? —Yes. The knowledge of psychical events which it offers us is valuable both from the point of view of the scholar and from that of the applied scientist. As physical science teaches us how to predict and prepare for or control events in the objective world, so psychology teaches us how to foresee and modify events in consciousness. Are there baneful psychological phenomena whose occurrence we should be able to anticipate and prevent, then we must look to psychology for the needed information. Psychiatry as a special branch of psychology is, indeed, concerned exclusively with the study of aspects of our mental life which demand control. Education is to a very large extent the conscious or unconscious application of psychological facts and laws. If the study of mind from the scientific point of view and by exact methods had accomplished nothing for the human race except to bring about rational medical and educational treatment of mental diseases and defects it would have doubly justified its existence. But the fact is that psychology is meeting varied demands for accurate, exhaustive, and useful knowledge of mental processes and of their conditions or causes. Apparently there is no sufficient reason for distinguishing the physical sciences from the psychical on the ground of values. Each group of sciences aims to satisfy our longing for knowledge and our need for the control of life. Both should increase human comfort and happiness. Both should tend to improve the race.

Psychology alone can give us self-knowledge.—We laugh sadly when any one is foolhardy or stupid enough to attempt to use electricity in utter ignorance of its properties, but even greater are the reasons for concern and pity when a human being is seen struggling through life ignorant of his psychological characteristics and possibilities. We have been taught by the hard lessons of physics that one should not attempt to deal with a locomotive or an aeroplane until he thoroughly understands its mechanism and capacities. Yet, all the experience of the ages has not sufficed to teach us the folly of using our minds in ignorance of their constitution, peculiarities, characteristics, and capacities. In spite of the fact that I am not a visualizer, I try to carry on work which demands this psychological characteristic. Ignorant or oblivious of the fact that I am defective in ability to distinguish colors, I undertake responsibilities which I can not properly fulfill. Careless of the inevitable results, if not wholly ignorant thereof, I persist in a harmful habit of thought or action until my mental development has been seriously distorted or dwarfed. In what department or phase of life are we so careless of facts and principles as in our mental life? Admitting that intimate and exact knowledge of the psychological make-up of the self is of inestimable value for success and happiness, we go forward blindly. Self-analysis, self-observation, introspection should teach us self-control. They should enable us to understand our likes and dislikes, our prejudices and prides, our peculiar strengths and weaknesses, our associations and memories, and in the light of this understanding we should rationalize our living, and especially our social relations, as would otherwise be impossible.

Psychology should help us also to understand other selves.—If knowledge of the self deserves to rank first in importance for the realization of the possibilities of the indi-

vidual life, knowledge of other selves deserves to rank next. Indeed, self-knowledge is the essential condition of the understanding and appreciation of other beings. At every turn in life's pathway we are forced to adjust ourselves to the thoughts, feelings, purposes of other persons. How can this be done intelligently if we are ignorant of our own mental peculiarities? How can we sympathize with the joy or sorrow of another when we have known neither of these experiences? As well might we insist that it is possible to act intelligently with respect to strychnine in ignorance of its properties, as to maintain that we can treat our own or another's mind properly in ignorance of what the science of psychology should teach.

Systematic self-observation leads to intimately valuable knowledge of one's self, and this self-understanding enables one to understand other persons. Finally the rational comprehension of the constitution of other minds serves as a condition for sympathy. We must be able to imagine ourselves in the midst of this or that desirable or undesirable event—storm, explosion, celebration, victory, fall—in order to adjust our behavior to the situation; and in precisely the same sense we must be able to imagine the experiences of our friend in order to act appropriately or sympathetically. Few of us, however, are sufficiently close and keen observers of our own or of others' minds to be able to understand them perfectly. Psychology, like the other sciences, is far from complete. It fails to do all that we expect of it simply because of the multitudinous unsolved problems which confront it. But this should serve as a stimulus to redoubled effort in research rather than as a cause of discouragement. Believing, as we do, in the importance of scientific knowledge of consciousness, of its facts, its principles, and its causal relations, for the understanding and appreciation of the self and of other persons and for the control of psychological events, the least we

can do is to insist upon the importance of more and better observation and experimentation.

Psychology has special value as genetic description.— This is an era in which the evolutionary account of things is in favor. Since the days of Darwin science has sought persistently to obtain the history of organisms. This it has done by careful comparison and the discovery of relations. The development of one thing from another has held attention, and from this study of genetic relations has arisen that history of living things which is now known as organic evolution. The solar system has evolved; the earth has evolved; man has evolved. The natural history of even the least important thing is found to be complex and full of startling events. Of most things we have only a partial history. There are many large gaps in the account of the evolution of man, and the same is true of almost all animate and inanimate objects. Nevertheless, we are no more in doubt concerning the existence of an evolutionary process than we are of the existence of the self.

Genetic or developmental description is in favor in physics, in biology, and in psychology. The physicist offers us an account of the evolutionary stages through which certain objects have passed in their progress toward their present condition. The biologist similarly offers us a description of the development of the human being from germinal cell to adult state. The psychologist in the same spirit formulates the developmental history of consciousness in the individual from birth to maturity, and in the race from its simplest beginnings in primitive organisms to its complex condition in the grown man. It is precisely this kind of description of physical, physiological, and psychological objects that is called genetic or evolutionary description. It might with appropriateness be called history, for in reality it offers a natural history of things.

Individual development.—Genetic description in psychology aims first to give the history of the mind of each of us from its just observable beginnings in infancy, through babyhood, childhood, youth and adolescence, maturity and senility, until finally, with the disintegration of the body, it passes beyond our powers of direct observation. It is this story of the mental life of the individual which fascinates students of psychology.

Racial development.—But there is another and no less important kind of genetic description. It differs from the description of the life of the individual between birth and death in that it traces the history of the individual into the remote past of the existence of its ancestors. This is known as phylogenetic or racial history in contrast with ontogenetic or individual history. Biologists have succeeded in proving experimentally that one kind of animal or plant may develop from a more or less markedly differing kind, and it is now commonly believed that more or less obvious changes from generation to generation, through thousands of years, account for the existence of a great variety of objects. The difference between a squirrel and a man seems very great, but if all the intermediate types of being which have intervened, and of which the majority have disappeared from the earth, were before us the evolutionary process doubtless would seem fairly simple. In order to give a complete history of the evolution of a given type of organism we should, of course, have to describe all of the stages or steps between its simplest animate ancestor and its present state. This is impossible. Consequently, most of the genetic descriptions which biology offers us are incomplete. Precisely the same holds true of psychology, for it is utterly impossible to trace the stages in the development of mind from its present condition in man back to its appearance among the ancestors of human beings. The best we can do is to follow the general trend of development.

Value of the history of mind.—In spite of its imperfections, genetic description in psychology serves the purpose of bringing into relation a lot of bits of information which otherwise would remain isolated. It makes these fragments of knowledge intelligible by enabling us to picture to ourselves a series of objects with definite relations. By the study of the minds of different organisms we discover resemblances which lead us to arrange the organisms in a certain order with respect to the psychological characteristics. Each individual or type represents a stage in the development of mind. Evidently such a description of mental life as genetic psychology offers is of value only as it enables us the better to understand mind as it now exists. This it does because it presents facts which are necessary for explanatory purposes. An important result of the search for the history of mind is the development of those special branches of the science which now go under the names plant and animal psychology, infant and child psychology, adult and senile psychology.

A provisional definition of psychology.—We have now reached the point at which we must formulate a provisional definition of our science in terms of the characteristics of its subject-matter, its aims or tasks, its methods, and its values. We may briefly sum up the essential points of the foregoing discussion in the following formula. *Psychology is the systematic study of phenomena of consciousness for the purpose of describing them in terms of their constituent elements and of giving their history, of discovering the principles and laws of their appearance, of explaining them by stating their causes or conditions, of correlating them with processes in the brain and in other parts of the body, and of thus providing us with that knowledge of mental life which should enable us to predict psychological events and to control them.*

This definition is not to be accepted uncritically. The

reader has enough preliminary information about the science of psychology, as a result of the foregoing chapters, to be able to formulate a definition for himself. He must not permit the dogmatic tone of the book to discourage him in this attempt, for the fact is that this tone is due not to the choice of the writer, but to the need for brief and definite statements. Disagreements with any views expressed in the text-book or by the teacher should bear fruit in the modification of the statements offered and in the wording of other definitions.

CLASS EXERCISE

Self-observation. Introspection of "my psychological traits." Materials: paper and pen or pencil.

Let each student, either in the class-room or outside, describe one or more mental traits which he believes to be peculiar to himself.

The reading of Sir Francis Galton's descriptions of "mental imagery, number-forms, color associations, and visionaries" in his "Inquiries into Human Faculty" will aid greatly in the performance of this task of self-observation.

If the time of the class permits, this exercise may profitably be extended into a study of "my mental characteristics," which shall be continued throughout the course and completed with a sketch of one's psychological self.

SUPPLEMENTARY READING

Galton, Francis: Inquiries into human faculty. Everyman's Library Edition (35c.). This book should be owned by every student of psychology, and thoughtfully read. It is sure to arouse one's interest in mental traits, or, as the author calls them, "human faculties."

Judd, C. H.: Psychology, chapter 15, "The applications of psychology."

Münsterberg, Hugo: On the witness stand. "Introduction," "Illusions," "The memory of the witness."

PART TWO

PSYCHOLOGY AS DESCRIPTION OF CONSCIOUSNESS

CHAPTER VI

CONCRETE EXPERIENCES, OR VARIETIES OF CONSCIOUSNESS

"My mind, then, is of the imaginal sort,—I wish that we had a better adjective!—and my ideational type is of the sort described in the psychologies as mixed. I have always had, and I have always used, a wide range and a great variety of imagery; and my furniture of images is, perhaps, in better than average condition, because—fearing that, as one gets older, one tends also to become more and more verbal in type—I have made a point of renewing it by practice. I am able now, for instance, as I was able when I entered the class-room nearly twenty years ago, to lecture from any one of the three main cues. I can read off what I have to say from a memory manuscript; or I can follow the lead of my voice; or I can trust to the guidance of kinæsthesis, the anticipatory feel of the movements of articulation. I use these three methods under different circumstances. When it is a matter of preparing a lecture on a definite plan, of dividing and subdividing under various headings, I draw up in the mind's eye a table of contents, written or printed, and refer to it as the hour proceeds. When there is any difficulty in exposition, a point to be argued *pro* and *con* or a conclusion to be brought out from the convergence of several lines of proof, I hear my own voice speaking just ahead of me: an experience which, in the description, sounds as if it should be confusing, but which in reality is precisely the reverse. When, again, I come to a piece of straightforward narrative, I let my throat take care of itself; so that I am able to give full attention to blackboard drawing or to the manipulation of instruments on the table. As a rule, I look to all three kinds of prompting in the course of a single hour."—Titchener, E. B.: Lectures on the experimental psychology of the thought processes, pp. 7-9.

The discovery of consciousness.—Each one of us has to discover consciousness for himself. This may seem strange. But is it really more surprising that we should

have to learn how to observe consciousness than that we should similarly have to learn to see things in the world about us? During infancy we are first conscious and then we become self-conscious. This process of becoming conscious of the self continues for years. In some of us it finally culminates in the ability to introspect or to observe consciousness with pleasure and profit. In others it leads only to a morbid self-interest or curiosity. Those persons who never discover themselves psychologically are to those who know themselves as thinking and feeling beings as the blind man is to the normally equipped and trained observer of nature. Clearly the first step toward an appreciation of psychology or toward making a psychologist of one's self is the discovery of consciousness.

Students of psychology belong to one of three classes: —(1) Those who of their own initiative discover themselves psychologically and are led by a glimpse of the wonders of consciousness to the study of the science of mind; (2) Those who are helped to discover themselves by a course in psychology, and who, with practice in introspection, learn to take keen satisfaction in the observation of psychological phenomena; and (3) Those who neither of their own initiative nor with the assistance of the trained psychologist are able to discover consciousness. At the beginning and again at the end of our course in psychology we should ask the question, To which of these classes do I belong? And we should answer the question honestly. Whatever the answer, we should not permit ourselves to be unduly discouraged, but instead we should will, with all our strength, to take the psychological attitude; to discover consciousness; to learn not merely how to introspect but how to do it well and with keen satisfaction; and, above all, we should not rest content until we see our thoughts, emotions, and sentiments as clearly with our mind's eye as we see the landscape with our bodily organ of sight.

The popular and the scientific knowledge of consciousness.—If a child should study the physical world by observing the simple parts into which scientists analyze things, instead of the things themselves, he never would know the world in which you and I live. Our everyday, common-sense, popular knowledge differs from that of the technical scientist precisely in that it has to do with complex objects and events as contrasted with simple elements and relations. Popular knowledge is concrete; scientific knowledge is abstract. The former seems natural, the latter artificial. Unless we happen to be chemists, mineralogists, or geologists, we are interested in mountains and valleys as features of the landscape or as sources of wealth and not as complex aggregates of chemical elements. The scientist speaks a language which only the initiated understand. He is occupied with the consideration of the nature and relations of atoms, molecules, cells, or whatever happen to be the products of analysis in his science.

This contrast between the popular and the scientific point of view and knowledge of things is just as sharp in psychology as in the physical sciences. The psychologist, starting with the concrete experiences which make up our conscious life, analyzes them into their constituent parts and thenceforth describes them in terms of these parts. Is it strange that we should not understand him? Is it strange that we do not realize he is talking about something with which we are perfectly familiar and in which we are intensely interested?

In taking up the study of psychology it is of first importance that we observe concrete experiences, the familiar furnishings of our minds, and from that task make the easy transition to the study of consciousness as it appears to the scientist. We must start with matters of common knowledge and by careful observation thereof learn to appreciate what is intelligible only after one has substi-

tuted the scientific for the popular point of view. It is futile to attempt to present the subject by discussing the results of psychological analysis without first making it perfectly clear that familiar, commonplace, concrete experiences are the things which are analyzed.

There are several varieties of consciousness.—For the concrete experiences with which we all are familiar we have many popular names. Certain of these names are also technical terms of the science of psychology. Such, for example, are sensation, emotion, and thought. But whereas popularly these terms are used very loosely and with wide variations in meaning, they are used scientifically with a much higher degree of precision. With the experiences of seeing, feeling, remembering, and imagining we are familiar, but of the exact nature and relations of these processes as phenomena of consciousness most of us know next to nothing.

For a long time it has been customary to classify the common experiences of life in three groups. The groups are knowing, feeling, and willing. This classification has proved useful in the past and it is still used to serve the purposes of introductory courses in psychology. But from the first, we should realize that it is a popular rather than a strictly scientific grouping of the facts of consciousness. In fact, it belongs on the same level as the classification of the objects of nature in the three categories of the vegetable, the animal, and the mineral kingdoms. Fortunately the old game of "Twenty questions" has demonstrated to us that it is impracticable to attempt to force all objects of the world into one or another of these kingdoms. Many concrete things belong as much in one as in another of the classes, and similarly many concrete experiences belong as much in feeling as in knowing or in willing. There is no sharp line of division between consciousness of the knowing sort, and that of the feeling, or willing, sort.

Usually we know, feel, and will all at once, or at least we do all of these things in connection with a single concrete experience. As I glance up from the page which I am writing, I catch the reflected sunlight from the snow-clad hillside beyond the Charles and my concrete consciousness for the moment includes knowledge of the view, feeling of discomfort because of the blinding light, and the volitional act of deciding to draw the shade. I did not know, feel, and will instantaneously, but it is quite impossible for me to separate my real consciousness of the moment into three independent parts.

Even from the moment of our discovery of consciousness we must seek to observe the various kinds of consciousness in their relations. We must study intellect, feeling, and will as aspects of consciousness and not as kinds or parts of experience. Nevertheless, it will be profitable for us at this point to note examples of knowing, feeling, and willing, with certain of their prominent characteristics.

Consciousness as knowing.—Knowledge constitutes a large part of consciousness. As a rule we couple the word with things or events and speak of knowledge of this or that object or occurrence in or about us. When we reply to the statement "This is a text-book of psychology" by saying "I know it," we assert that our consciousness includes awareness of a particular object. This awareness or knowledge may vary. It may be limited to consciousness of the words "this is a text-book of psychology." It may include also consciousness of the appearance of the object as it is seen in daylight; of its weight, its texture, and even the odor of its binding. To say that we know the book means that we are aware of a few or of many of the features or characteristics of the object. Knowing always involves sensations or sense images. We may know the book as an object here now, or as an object which we

saw and handled and read yesterday, or as an object described to us by another person.

It is in terms of knowledge that we describe the world in which we live, and ourselves as physical bodies. When we perceive, remember, imagine, and think, we are having conscious processes which must be classed with knowledge rather than with feeling or will. Perhaps the simplest sort of knowledge is awareness of a sensation. As the dentist with a quick steady pull withdraws the slender twisted wire from my tooth I experience a sudden, momentary, intense sensation of pain. For an instant my awareness is limited to this bit of consciousness. The pain is knowledge with inward reference. It is a part of my consciousness of self, and in this it differs strikingly from my knowledge of the book, for that I refer to something not myself.

When we know objects or events in the physical world through the medium of our senses of sight, hearing, touch, taste, temperature, and the other modes of awareness, we speak of perceiving them. We may perceive a simple sensation, as in the case of the intense pain on the injury of a nerve, or we may perceive a group of sensations as in the case of our consciousness of the book and, indeed, of most objects and occurrences. In any event to perceive always means to know more or less completely.

Knowing as remembering.—A second form of knowledge is called memory experience. To-morrow I may remember or re-live the pain of having a tooth extracted; I may be conscious of the book although it is not before me. To remember is to know something as a previous experience. It is one of the most important of the human types of knowledge. Lacking memory our conscious lives would be like a perpetually moving and endless series of kinematographic pictures. We should live in the experience of the moment; there would be no past, and no future.

Knowing as imagining.—There is a third form of knowledge, closely related both to the perceptual and to the memory experiences. It is imagination. The newly discovered African animal, which I have never seen with my own eyes and which I am therefore incapable of knowing either in perception or in memory, I can represent to myself in imagination. As I write this paragraph I imagine experiences which will serve as illustrations for the text; I imagine combinations of words which are new; I imagine the appearance of the printed page upon which this discussion of knowledge will in due time appear if I remain faithful to my task and the printers and publishers lend me their aid.

Knowing as thought.—Finally, as a fourth kind of knowledge, we have thinking. It is a vastly more complex kind of consciousness than awareness of sensation, perceiving, or even than remembering and imagining, for as a rule it makes use of two or more of these kinds of knowledge. The simple thought "this is a text-book" is an experience which involves first, knowledge of "this," a particular object; second, knowledge of "text-book," a particular sort of "this"; and finally, knowledge of the likeness between "this" and "text-book." When we judge, when we reason, we are thinking. This is a kind of knowledge which seems to be characteristic of human beings as contrasted with other animals. The cat and the canary sense, perceive, remember, and possibly imagine, but we have meager grounds for assuming that they think.

Consciousness without knowing.—Man is an intellectual being a large portion of whose time is given over to those experiences which we choose to speak of as knowledge. Imagine, if you can, your consciousness minus all the types of experience described in this section. What would it be like? There would be no sensations, no awareness of objects or events, indeed, there could be no external

world and no physical self. Consciousness would consist solely of feelings and volitional experiences. And what would these be like? To answer this question we must turn to the description of the concrete experiences of feeling and will.

Consciousness as feeling.—Feeling is inextricably interwoven with knowing and willing. Yet, it is possible, by the highly artificial process of limiting one's view to a particular aspect of consciousness, to regard it introspectively as a special kind of experience which sometimes stands out prominently. In the category of feeling belong our consciousness of liking and disliking, of agreeableness and disagreeableness, and our emotions.

Our consciousness of a particular person may be purely intellectual or it may include a feeling for the person. We may have an all-pervading feeling of agreeableness, or even an emotion of joy, whenever we see or think of the individual, and this may be quite as important a part of our awareness of the person as is our perceptual knowledge. It is difficult to imagine a rich life of feelings and emotions without knowledge, for the simple reason that we usually refer our emotions and feelings to objects of knowledge. But this clearly is not a sufficient reason for saying that we must know before we can feel. It is conceivable that infants and lower animals have consciousness of the agreeableness disagreeableness variety long before, or even in the permanent absence of, any form of knowledge. They merely feel comfortable or uncomfortable, satisfied or dissatisfied, quiescent or restless.

It is well worth while to try to think of a conscious life which consists only of feelings and emotions. Try to introspect the experience which pervades consciousness on the successful completion of a difficult and fatiguing task. There is satisfaction, relaxation, rest. One feels comfortable. A general agreeableness seems to monopolize con-

sciousness. It is the prominent thing about our awareness that it may thus be dominated by a particular kind of experience. Or, as an even more striking example, take the consciousness of having a tooth pulled. The intellectual feature of the experience is the sensation of pain, but as a matter of fact this is usually the least prominent of the aspects of our consciousness at the moment. We feel intensely uncomfortable, and we will to stand or to avoid the discomfort. It is feeling instead of knowledge which holds the center of consciousness at such moments, whereas at other times the reverse is true. The sensation of pain, apart from the intensely disagreeable consciousness which accompanies it in the dentist's chair or upon the operating table, is introspectively interesting. It pays to try to attend to it, for the concentration of attention upon the intellectual instead of the affective or feeling content of consciousness tends to diminish the disagreeableness of the experience. At times one may thus wholly neglect and almost wholly avoid the discomfort. But no one should be asked to accept such a statement on faith! Every one should try it.

The confusing of feeling with knowing.—It is easy to confuse feeling with knowledge for they regularly occur together. Indeed, not a few psychologists have agreed to regard feeling as an attribute of certain intellectual experiences instead of as a distinct kind or variety of consciousness. This is not the most profitable assumption for us to adopt at the beginning of our introspection, for it is excellent training to try persistently to discover whether feelings are distinguishable from sensations and other forms of knowledge. The student who is able to observe both the peculiar character of the sensation of pain and the nature of the feeling of discomfort which happens to accompany it, deserves credit for his observation even though authorities disagree. For myself, I find them distinguishable. The peculiar pain quality which I experience every

time a nerve is pressed or stimulated electrically is as different from the so-called feeling of pain, or as I prefer to call it, the feeling of discomfort, as light is from darkness or hunger from thirst. I dislike the pain quality because it is associated with a disagreeable feeling, and in the same fashion, although to a less extent, I dislike the purple quality of visual sensation because it is associated with a disagreeable feeling. It is easier to distinguish the two aspects of consciousness in the latter case than in the former because as a rule neither is so extremely vivid or intense.

Feeling as emotion.—Our emotions are complex experiences made up of cognitive (i.e., "knowing") processes, of feelings, and of volitions. They are classed with feelings simply because in them feelings usually are predominantly important.

At the sight of a long-lost friend we are swept from the straightforward course of our intellectual life by a surging emotion of joy. There are elements of knowledge in the experience, for we recognize the friend and remember a multitude of facts concerning the personality, and there are also elements of will, for do we not suggest a lot of unformulated queries by the form of welcome which we give and the immediate turn of conversation? Yet above these elements, and incalculably more important, is the satisfaction, the agreeableness, of the experience. It is that which dominates consciousness. But we remain thoroughly joyous only so long as the cognitive and volitional aspects of consciousness are kept in the background.

A startling accident fills us with horror. Our cognitive and volitional experiences at such times are so far subordinated that we stand aghast, incapable of action. Feeling is in the forefront of consciousness and we are momentarily in the grip of a powerful emotion. To dissect the emotional consciousness and reveal the relations of the

many and complex processes which go to make it up is the task of the skilled psychologist. At present we need go no further than to note that feelings, whether of the emotional or of another type, are readily distinguishable from forms of knowing.

Consciousness as willing.—The volitional experience has been referred to several times in the above accounts of knowing and feeling. It constantly appears in connection with them. Merely to know and to feel would be to remain passive. It is the volitional consciousness which prepares us for action and impels us thereto. But we must know and feel before we can desire or choose—before we can will. As it is possible to imagine ourselves mere creatures of intellect or of feeling, so we may imagine ourselves mere creatures of will. But how pitiable would be our plight were we merely intellectual, emotional, or volitional. The consciousness of impulse and of decision, which are preeminently important features of will, would be blind. Indeed we should be like the brutes who are impelled to action by their instinctive impulses. It is not easy for most of us clearly to distinguish willing from knowing in introspection, but difficulties need not and should not discourage us.

Let us select some perplexing situation and observe critically and repeatedly the characteristics of our consciousness as we attempt to decide whether to do the task set us or to enjoy an hour at tennis, whether to obey the rule or to break it. Almost any moment of our waking life furnishes us with opportunities for introspection concerning knowledge, feeling, and will. Just now, as I conclude this paragraph, I am conscious of several things I should do before luncheon as well as of the desire to continue writing. The introspection proves interesting and I stop a moment to examine its products. Immediately I arise and go to the telephone. The volitional process gained

predominance just as soon as my cognitive consciousness waned.

Professor Thorndike's way of classifying experiences.—To distinguish the knowing, feeling, and willing kinds of experience is only one of several profitable ways of arranging the first products of self-observation. Professor Thorndike, in his "Elements of Psychology," offers a somewhat different method of classifying. He distinguishes five kinds of experiences, to all of which he applies the word feeling. They are (1) Feelings of things and qualities as present (sensations and percepts); (2) Feelings of things as absent (images and memories); (3) Feelings of facts (relationships, meanings, judgments); (4) Feelings of personal condition (emotions); and (5) Feelings of willing.

In general it may be said that the first three of Professor Thorndike's classes of feelings are subdivisions of what we have considered above as "knowing"; that the fourth class is co-extensive with "feeling"; and that the fifth class includes "willing." It is useful to subdivide our "knowing" (intellectual, or cognitive) experiences thus, for it aids us in discovering the several varieties of knowledge. Even the novice in psychology should soon discover that his consciousness of things as present is quite different from his consciousness of the same things as absent. And similarly, he should distinguish his consciousness of things and events from his consciousness of facts. It is excellent practice to attempt to classify one's experiences either as "knowing," "feeling," and "willing," or according to Professor Thorndike's method.

Experiences may be classified according to degree of complexity.—There is one serious objection to the ways of grouping experiences which we have been examining. They are likely to make us think of consciousness now as purely intellectual, now as purely affective (the feeling sort), and

again as purely volitional. This is not the case, for we know and feel and will in the same moment of consciousness, and our ability to describe a given experience as cognitive, affective, or volitional is due merely to the fact that some one of these three aspects of consciousness is more prominent than the others. We would do better to call them aspects than kinds of consciousness.

Now, there is a method of viewing experiences which avoids this objection. It is classification according to the complexity of the experience. Professor Wundt has employed this method in his "Outlines of Psychology." He distinguishes (1) Psychical elements; (2) Psychical compounds; and (3) Interconnected psychical compounds. A sensation is a psychical element, a percept, idea, or emotion is a psychical compound, and a judgment, thought, or train of associations is an interconnected group of psychical compounds.

This way of arranging experiences is especially useful because it forces us to note the constitution of the things we are trying to classify. At the same time, it is highly desirable that we examine consciousness as concrete experience until we can readily distinguish its knowing, feeling, and willing aspects, as well as its elements, its compounds, and its interconnected compounds. To begin the scientific study of consciousness without a general preparatory familiarity with these several aspects of our experiences is much like undertaking to study the structure of an animal's retina before making a general examination of the eye.

CLASS EXERCISE

Self-observation. The introspective analysis of the (cognitive) consciousness of a pencil. Materials: paper and pencil.

The members of the class should attempt to discover the psychological elements which enter into the consciousness of the pencil. What is the pencil, psychologically, apart from, or in

addition to, these bits of consciousness—sensations of color, smoothness, etc.? Write as complete and accurate a description of the pencil as a physical object as you can, and then compare with it your similarly detailed description of it as an object of your consciousness. Wherein do the two differ? Supposing the two descriptions to be accurately written by all the members of the class, what are likely to prove to be the essential differences between the physical and the psychological pencils? Does this study of the pencil from the points of view of physics and of psychology justify the assumption of physics that the object is independent of me as an observer? Does it justify the assumption of psychology that it is dependent upon me as an observer?

If time permits, other objects may similarly be analyzed and the results of introspection presented for class-discussion and criticism.

SUPPLEMENTARY READING

Thorndike, E. L.: Elements of psychology, chapters 2-7.
Calkins, M. W.: Introduction to psychology, chapter 12.
Höffding, H.: Outlines of psychology, chapter 4.
James, Wm.: Principles of psychology, vol. 1, chapter 9.

CHAPTER VII

ANALYSIS AND THE PROBLEM OF PSYCHOLOGICAL ELEMENTS

"Smelling furnishes me with odors; the palate with tastes; and hearing conveys sounds to the mind in all their variety of tone and composition. And as several of these are observed to accompany each other, they come to be marked by one name, and so to be reputed as one thing. Thus, for example, a certain color, taste, smell, figure, and consistence having been observed to go together, are accounted one distinct thing, signified by the name apple; other collections of ideas constitute a stone, a tree, a book, and the like sensible things."—BERKELEY, G: The principles of human knowledge, *Fraser*, vol. 1, p. 257.

Analysis as a scientific procedure.—It is our habit to accept the objects in our world, our own bodies, and everything which happens about and within us as simple facts. We are interested in them, and we may even describe them at length by comparing and contrasting them with one another. But we do not ordinarily tear them apart for the sake of discovering their constitution. It is precisely in this respect that the scientific procedure or attitude toward things differs from the common-sense or non-scientific attitude. Instead of simply accepting things as what they appear to be, the scientist sets about discovering whether what seems to be simple really consists of parts. Having succeeded in breaking up or analyzing the object with which he started, he next studies the relations of the parts, the way they act independently, and the various ways in which they may be put together. In a word, he seeks intimate and detailed knowledge of the composition and constitution of his object. The result is that the scientist usu-

ally knows vastly more about things than does the ordinary observer.

The process of analysis in chemistry.—The common sense and the scientific attitudes are readily brought into contrast. We have but to inquire, What is a pinch of table salt from the one point of view and from the other? For you and me, it is a simple whitish, soft, moist substance with a characteristic taste. For the chemist it is this and more. He really begins his description where we leave off. Instead of accepting the salt as what it seems to be, he analyzes it into its constituent parts, sodium and chlorine. Each of these products of analysis he is able to describe by enumerating its characteristic properties. But this does not complete the scientific account of a crystal of salt. For the chemist has discovered that each of the chemical elements which go to make up a molecule of sodium chloride is composed of particles called atoms, and we may not say that the atom is the ultimate product of chemical analysis. At any time it may be shown to consist of yet simpler particles of matter.

It is important to note that whereas the so-called "chemical elements" are evident to our senses, the atom has only recently and indirectly been detected. Sodium and chlorine, like lead or copper, can be seen and touched, but the atoms which constitute them ordinarily are beyond our powers of observation.

Long before their presence could be demonstrated to the senses of man, the existence of atoms was postulated by the chemist for the purposes of description and explanation, and even then he believed in them as firmly as in the things which are seen.

The process of analysis in biology.—The beautifully colored sea-anemone is an object of interest to the non-scientific observer as well as to the biologist. Yet, how true is the statement that it really is not the same object

for both. You and I describe the animal by calling attention to its coloration, its general form, and its activities. The skilled biologist begins where we leave off. To the casual observer he reveals the fact that the anemone is composed of certain parts or organs, and that each of these organs is composed of minute active living parts which he calls cells. He even describes the relations of these minute cells to one another, the ways in which they work together for the welfare of the animal, and the special work or function of each cell or cell-group. How different one's knowledge of an anemone when it includes all of these facts, and many more like them, in addition to the readily obtainable information with which scientific study begins.

Psychological analysis.—The idea of snow and the emotion of fear, are psychological objects. To the casual or the untrained observer they seem simple, just as does the crystal of salt or the sea-anemone. Indeed, it requires long and patient observation to discover that the idea and the emotion are composed of certain simpler psychological processes.

In the foregoing chapter we have summarily considered concrete experiences and certain ways in which they may be classified. It is just these concrete experiences which interest the unpsychological observer and gradually draw him into the study of the science of psychology. As the biologist starts with the apparently simple anemone and by thorough and long-continued observation reveals its vast and fascinating complexity of structure, so the psychologist starts with concrete experiences, with ideas, thoughts, feelings, emotions, and ultimately discovers their complex constitution.

So long as we are not psychologists, an emotion, or any other concrete experience, is merely something to live through, something which we like or dislike, seek or shrink

from, vividly recall or attempt to banish from consciousness. But as soon as we become psychologists the same emotion becomes, also, a complex of psychological elements whose number, characteristics, and relations we are eager to discover.

Truly analysis is the first strictly scientific task of the psychologist. For he must discover the simple processes which go to make up mental life; and learn what he can about their nature and relations. In psychology, not less than in the other sciences, the process of analysis is highly artificial and unnatural, and tends to suppress interest in the living of experiences in favor of an interest in understanding them.

The analysis of my consciousness of the typewriter before me is like the biologist's analysis of the sea-anemone. Both are matters of simple and persistent observation, aided to a certain extent by experimentation. In studying the typewriter, as a physical object, I may find it necessary to take it apart in order to discover the number, nature, and relations of the several parts. Similarly, in studying my consciousness of the machine, it is necessary for me to resolve the total consciousness into simpler parts in order to understand, describe, and explain the experience. I remove the keyboard of the machine and thus discover certain facts of construction. I remove my sensations of sight from my present consciousness of the object and discover that they are important parts of the experience.

As students of the sciences we can not too early or too well learn that scientific discovery depends upon ingenuity and patience. The more ways in which I can think of examining and testing my consciousness of the typewriter, the more I shall succeed in discovering concerning that consciousness. If the biologist confined himself to an examination of the external surface of the anemone instead of dissecting it, if he used his unaided eye instead of the

microscope, the description which he would give would be very different from that suggested above. Analysis uses many and various aids, but it is always a matter of observation.

A simple example of psychological analysis.—It is natural and inevitable that most of us should have difficulties at first in imagining psychological analysis. Things experienced seem so entirely whole and unitary that it is impossible to think of them as made up of parts. We have to get into the way of taking the scientific attitude. The consciousness of a sound which is produced by sharply striking a tuning fork is a simple experience for the ordinary observer. It seems to be just a sound: one can not think of other sounds which if added together would produce the same consciousness. Yet, how different the statement of the psychologist. After careful and persistent study, he asserts that this auditory experience in reality consists of the experience of the noise due to the blow of one object against another, of a tone which is due to the primary vibrations of the fork, and of certain over-tones which accompany the fundamental tone. The more expert the observer the more over-tones are detected. Thus it appears that the seemingly simple sound is surprisingly complex. Psychological analysis in this instance proves that it is impossible to describe the experience accurately without taking into account its constituent parts. Indeed, knowledge of the constitution of our various experiences is just as necessary for accurate and valuable descriptions of mental life as knowledge of the materials which have been used in its construction is for the description of a building.

The products of psychological analysis.—The chemists have discovered between eighty and ninety elements as constituents of the world. Psychology has many more elements, but they fall into a few classes. At the most there are only

four classes which are widely recognized. They are termed sensations, images, affections, and conations.

A word in description of each of these varieties of products of psychological analysis will render them intelligible to every one, and help to make them distinguishable in introspection.

Sensations are those experiences, such as colors, tones, tastes, odors, pains which we uniformly refer to a definite bodily organ of sense.

Images are faint copies of sensations which arise in the absence of the stimulation of an organ of sense.

Affections are those feelings of agreeableness and disagreeableness, present in almost every state of mind, which we can not definitely refer to any particular portion of the body, but which seem rather to be all pervasive. It should be noted that the word affection is here used as a technical psychological term and not in its common meaning. For psychology it refers to feeling, whereas in ordinary speech it refers to a particular emotional attitude toward some object.

Conations are the experiences of effort which appear usually in connection with willing. It is much more difficult for the beginner to discover conative processes of consciousness than sensations or affections. Perhaps the best opportunity for observing them is offered in the experience of trying to remember. At any rate, it is worth while for each of us to notice whether in the experience of trying to recall a name, there is something which is not sensation, image, nor affection.

Relation of sensation, image, affection, and conation to knowing, feeling, and willing.—The thoughtful student will have correlated these statements concerning psychical elements with the first classification of concrete experiences given in the previous chapter. Sensation and image as elements seem to belong primarily to "knowing"; affec-

tion seems to belong to "feeling"; and conation to "willing." It may even have occurred to some one that the discovery of three chief elements in consciousness—sensation, affection, conation—may be due in no small measure to the fact that concrete experiences are conventionally placed in three classes. Possibly this tripartite division of experience has misled psychologists. Possibly they have allowed it to prejudice them in favor of three and only three kinds of psychical elements. At any rate, we may fairly ask whether this analysis of consciousness is acceptable to the majority of psychologists and whether it finds support from our introspection.

How many kinds of elements of consciousness are there?—Psychologists disagree as to the number of psychological elements. There are those who maintain that sensation is the sole element. There are those who insist that sensation and affection are the only kinds of elements. And, finally, there are those who believe in the existence of three (sensations, affections, and conations) or more classes of elements.

A question of fact.—Does analysis reveal only sensations and are the so-called feelings of agreeableness and disagreeableness, of effort and strain, merely aspects or complexes of sensations as certain observers maintain, or does self-observation indicate the existence of images, affections, and conations, along with sensations, as distinct kinds of psychic elements?

At the beginning of one's introspection it is difficult to believe that all concrete experiences are complexes of sensations. Rather we tend to believe that our feelings or affections are quite different in character from our sensations. This tendency is well expressed by Professor Calkins in her discussion of attributive elements of consciousness. "It needs no text-book in psychology to convince us that our analysis of consciousness is incomplete when we have

merely enumerated the sense-elements. For, quite as prominent as the sights and sounds and fragrances and all the other sensational parts of our experiences are the pleasantnesses and the unpleasantnesses. Now these are clearly elemental feelings. One can no more tell what one means by agreeableness or by disagreeableness, than one can tell what redness and warmth and acidity are: in other words, these are irreducible experiences, and they are perfectly distinct from each other as well as from the sensational elements." (Introduction to Psychology, p. 113.)

On the other hand, those psychologists who discover in consciousness only sensation-elements maintain that introspection reveals sensations to have a certain attribute or property which they call their feeling-tone. It is this attribute of sensations which renders them agreeable or disagreeable. Furthermore, they hold that combinations of sensations with very marked feeling-tones constitute our feelings and emotions. From this point of view, feeling is a part of sensation, not a separate psychic element.

It is only fair to psychology to state that this view is not generally accepted, but rather is in disfavor. Psychological as well as popular opinion tends strongly to the acceptance of the view stated by Professor Calkins.

There are extremes in the matter of psychological elements.—The belief in a single kind of element marks one extreme. The belief in an indefinitely large number of elements marks the other extreme. But much more widely and safely held than either of these extreme positions is the view that there are at least two classes of elements, sensations and affections, and that there may possibly be certain relational elements which belong in neither class.

Although there are only a few kinds of elements, each class has many examples.—Of sensation-elements there are thousands of instances. The class contains, according to the results of introspection, at least fifty thousand elements. These are known as sensation qualities. We distinguish a sensation of redness from one of blueness, but further than this, we also distinguish a particular sensation of redness from many other sensations of redness. A loud tone is readily distinguishable from a low one, but of loud tones there are many different kinds which we do not confuse and for some of which we have special names. So it is with all our special senses; each includes a large number of qualities of experience to which we apply the term psychic elements.

The same statements hold true of affections. The class of elements to which we are applying the term is readily divisible into agreeable and disagreeable affections, and in these subclasses we recognize varieties of agreeableness and disagreeableness. We must not therefore allow ourselves to think of psychological elements as few; it is only the large classes of elements that are few.

Physical science makes use of two kinds of elements.—The products of scientific analysis may be classified as sensible and hypothetical. The chemical elements—copper, iron, sodium, potasium, iodine—may be seen, but chemistry makes use also of a product of analysis called the atom which has never been seen but whose presence has recently been demonstrated visually. Similarly the biologist, to whom the cell, as the structural unit or element of the organism, is revealed by the microscope, assumes that each cell is composed of unseen molecules and these in turn of atoms. For the purposes of description and explanation these invisible hypothetical elements are quite as important as those constituent parts of objects which may be seen and touched. Moreover, the scientist believes as firmly in the

existence of the one as in the other product of analysis, and realizes that at any moment the insensible may be rendered sensible.

Psychology also may deal with elements which may be directly observed and with those whose existence is assumed.—Our sensations, affections, and conations correspond to the sensible products of physical analysis, to the chemical elements and the elements of biology. But each of these varieties of psychological elements may consist of yet simpler bits of consciousness which might be called psychic atoms.

This subject has been interestingly discussed by Professor Münsterberg. Starting with the assumption that all experiences may be analyzed into sensations, he writes: "Are these sensations the ultimate elements of the contents of our consciousness, or is that which we call a blue or hot sensation, a sweet taste, a tone C, a muscle sensation, or a pain sensation itself a complex affair which consists of more elementary parts: in short, have we in the mind ultimate elements which are simpler than the sensations? . . . It seems at first surprising that psychology in its modern form has hardly ever seriously raised this question, and has always stopped in its analysis as soon as the distinguishable sensations have been reached. Physics did quite otherwise: it never stopped at the point where the observation of the biologist or physicist or chemist found the last mechanically separable parts. Theoretical physics went far beyond that point, and saw its goal in a description of the physical universe according to which those cells and molecules and chemical substances are combinations of atoms which are unperceivable; and the atomistic theory of the universe which necessarily transcends empirical observation is to-day the basis of all natural science. Why has psychology never felt this demand which seems to physics so profound and so natural?" (Münsterberg, Hugo:

Psychological Atomism. *Psychological Review,* vol. 7, pp. 4-5. 1900.)

As students we must seek first familiarity with perceivable elements of consciousness.—Theoretical psychology has its place, but it would be a great mistake for one to enter upon the study of consciousness by building atomic hypotheses. The first products of psychological analysis—sensations, images, affections, and whatever other processes introspection may reveal—are our sole concern in this book. If we succeed in learning how to observe them easily and accurately, we shall have taken an important step toward making psychologists of ourselves, and we shall have abundant reason to be satisfied with our progress.

CLASS EXERCISE

Self-observation. Continuation of the introspection of the consciousness of pencil. The memory consciousness may, at the beginning of the exercise, be observed in contrast with the original perceptual consciousness.

SUPPLEMENTARY READING

Titchener, E. B.: Text-book of psychology, § 9.
Judd, C. H.: Psychology, chapter 4.
Wundt, Wm.: Outlines of psychology, § 6.
Münsterberg, Hugo: Psychological atomism. *Psychological Review,* vol. 7, pp. 1-17. 1900.

CHAPTER VIII

SYNTHESIS: THE BUILDING OF COMPLEX EXPERIENCES

"If an analytic result shows the true elemental constituents, it should be possible, at least in a good many cases, by adding the elements one by one, to rebuild the original experience. Surely no better test of the accuracy of an analysis is possible than the reinstatement of the whole through synthesis of the products of dissection. . . . If we take advantage of special and constant conditions for the dissection of mind, why may we not as well make use of these conditions in building up mind again? To make the matter concrete: why should we not, if we find that liquidity is a perception made up of a number of known elements, bring these elements together artificially and produce the perception in question? . . . Pressure and temperature are evidently the two important factors in liquidity. . . At first the subjects declared that the wetness was something added to the pressure and temperature: it was, for them, unique."—Bentley, Madison: The synthetic experiment. *American Journal of Psychology*, vol. 11, pp. 405, 416. 1900.

Synthesis as a scientific procedure.—Synthesis is said to be the opposite of analysis. When we analyze a physical object, or an experience, we resolve it into its constituent parts or elements: when we synthesize the same object or experience we put the parts together again in their former relations so that the original object reappears. In every science the process of analysis must precede attempts at synthesis, for parts must be isolated before they can be reunited. Synthesis is of special importance and interest in science because it is our chief way of creating things. Whether we attempt to build a house or to manufacture a useful dyestuff, we employ a synthetic procedure.

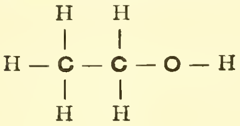
A part of the wealth of information which is necessary

for successful synthesis is revealed by the process of analysis, but the greater part of it is obtained by other and various methods. Before the chemist can artificially create a substance he must know not only the elements which should be used, but also the properties and the exact relations of these elements. Certain of these facts are revealed to him by analysis and others he obtains by special study of the products of analysis. Indeed, it may be said that the analytic procedure of the scientist is only the beginning of a long and varied series of processes, the crowning success and climax of which is perfect synthesis. For when we know so much about the constitution of a physical object or a psychological object that we can at will cause it to appear from the midst of its constituent elements we have achieved the goal of science.

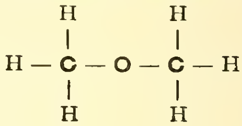
Chemical synthesis.—There is no science in which the importance of the synthetic procedure is clearer than it is in chemistry. During the present generation the increase in our knowledge of the structure or constitution of inorganic and organic substances has revolutionized many industries. Certain dyestuffs which formerly were obtained from plants are now manufactured in great commercial laboratories, with the saving of untold millions of dollars. The chemist has learned that knowledge of the composition of things is only the first step toward ability to create them. He knows that synthesis can be accomplished only in the light of knowledge of the relations and properties of the elements of which the substance is made up. In other words, the *constitution* as well as the *composition* of a chemical object must be known before it can be made synthetically. The same elements differently arranged yield substances of unlike properties. Ethyl alcohol and dimethyl ether are composed of the same chemical elements, carbon, hydrogen, and oxygen, but the atoms of these substances are differently arranged in the alcohol and the

ether. This difference the chemist represents pictorially by the following formulæ:

STRUCTURAL FORMULA FOR ETHYL ALCOHOL



STRUCTURAL FORMULA FOR DIMETHYL ETHER



The psychologist has excellent reason for believing that isomerism, as this phenomenon of like chemical composition and different properties is called, exists in the realm of consciousness, and he does well to use the analytic procedure as an approach to that knowledge of the constitution of experiences which will enable him to represent the psychic elements in their relations. It would not be rash to predict that the study of psychological isomerism by methods as ingenious as those which have established the science of synthetic chemistry will yield us startling and invaluable knowledge of mental life, as well as power over it.

It is easy to analyze; it is difficult to synthesize.— All that has thus far been said about the analytic and the synthetic procedures in science indicates that the ignorant may analyze, while only the wise can synthesize. Who of us has not met with the trying experience of unintentionally disarranging the parts of a complex object which we were incapable of rebuilding. It is easy for the novice in anatomy to analyze an animal's skull into its constituent bones, but it requires considerable knowledge to synthesize the object from its constituent parts. To disarrange, break up, or dissect a jigsaw puzzle into its few score of parts takes but a moment of time and little thought, yet, how laborious the process by which these parts must be fitted together if the picture is to be reformed. And how different the

knowledge of the object which one derives from breaking up (analyzing) and from putting together (synthesizing) the puzzle. Doubtless our experiences with such objects as carefully prepared skulls and picture puzzles make analysis appear easier than it really is in science, but they certainly do not over-emphasize the difficultness of synthesis. The fact is that in analyzing anything physically or psychologically we learn a great deal about it. That is just the reason for analysis. And it is also a fact whose scientific importance should not escape us, that in attempting to synthesize what we have successfully analyzed we learn vastly more about it.

All of our concrete experiences are products of natural syntheses.—Professor Wundt emphasizes the fact that "pure sensations" and "simple feelings" are not to be found in consciousness as concrete experiences. They exist only in more or less complicated relations to one another as groups of psychological elements. Like the atoms of chemistry, they are abstractions which are useful in the description of objects. All of the real experiences which we are interested in as men and as psychologists are complexes of sensations, images, and affections. Professor Wundt very profitably and logically discusses these products of natural synthesis as "psychical compounds" and "interconnections of psychical compounds." And in so doing he makes it clear that in analyzing our experiences we really reverse the synthetic process and attempt to resolve these complexes into their parts, whereas in synthesis of the same complexes, we attempt to bring the parts together again in their proper relations.

An excellent example of the process of synthesis which continually goes on in our minds is furnished by the following experience which I take immediately from my introspection. I am aware of an object before me which I call an ink-bottle. As I review the past few moments I note that my consciousness of the particular object grew by the

combining of certain sensations and feelings. First of all there were the sensations of light and color—black, white, red, yellow—of label and fluid and the variations thereof which came to me as I looked at the bottle from different points of view. Then there were the sensations of coolness, of smoothness, of stickiness (where the ink had spilled over the bottle), of contact and pressure, and of weight as I lifted the object from the desk. Finally, I experienced yet other sensations as I removed the cork from the bottle and smelled the ink. Accompanying the sensations, I noted certain agreeable and disagreeable feelings. The coolness of the bottle was agreeable; the stickiness and the odor were disagreeable. This natural process of the growth or upbuilding of my consciousness of the object is typical of what is constantly going on in our minds.

It is fascinatingly interesting to observe the growth of conscious complexes, and it is equally interesting to reverse the process and by an analytic procedure break them up into their simpler parts or elements. Self-observation may be used with profit both in the study of the natural synthesis of conscious elements and in the study of the constitution of complexes whose growth has not been observed.

Simple examples of synthesis in psychology.—Just as it is difficult for the beginner to think of an experience as anything but what it is, a whole or unity, so it is difficult for him to conceive of a complex experience being built up by the welding together of simpler bits of consciousness. Examples of the results of synthesis will lessen this difficulty.

We all know what harmony and discord mean in sound experiences, and we know too from the previous chapter that certain apparently simple experiences of sound are analyzable into simpler parts or psychological elements. Given the fact that certain combinations of these elements of sound experiences are harmonious and others discordant

or inharmonious, the problem of synthesis is to discover how to create either kind of experience at will. Often a musician can answer the question, What elements of consciousness must be combined, and in what relations, if discord is to result? This may lead to the suspicion that the knowledge is not psychological. But the truth is that the skilled musician has a practical knowledge of the psychology of auditory experience which far surpasses in extent and thoroughness that of most professional students of consciousness. He may not recognize his knowledge of the elements of auditory experience, and of their relations, as psychological, but it is not the less so for that reason. Ask any musician how to produce an harmonious or an inharmonious sound by combining tones and he will immediately tell you of several ways.

Similarly the skilled and successful artist has a practical knowledge of the elements and relations of color experiences. Certain color sensations tend to fight with one another, we are told; others agree or harmonize. This knowledge is invaluable if one wishes to obtain a certain artistic or economic effect. Again, color combinations have a marked effect upon the apparent warmth of a scene. It is not a foolish question to ask how a room may be furnished to make it seem warm, or small, or low, or cozy. The arrangement of those psychological elements which together make up the experience of the room determines these matters. It is the psychologist's business to know precisely what elements and in what relations will yield a given experience.

To take another practical example, there are daily being created in the bakery and in the kitchen combinations of substances, each sapid and more or less likely to arouse our satisfaction, which "taste good." Into the ordinary culinary product go half a dozen or even a score of substances which have specific tastes and odors. How is the

cook able to predict the gustatory experience which will result from these combinations of substances? Unfortunately she does not with certainty. Frequently she depends upon trial and error! But nevertheless, it is possible, by a careful study of the elementary sensations of taste and smell and of their relations, to discover which are harmonious and which are inharmonious; which tend to destroy one another and which tend mutually to strengthen one another; which combine in such a way as to produce a new taste or odor entirely different from any of the elements, and which refuse to combine. Each of us can from introspection produce examples of these sorts of experience. Now it is the duty, as well as the business, of the psychologist to furnish the information which will enable the cook, no less than the musician, the painter, or the house furnisher, to create objects, satisfactory according to their kind, not by a hit or miss method, but with the certainty and economic skill and saving which come from definite knowledge and foresight. This indeed is the psychologist's duty and privilege just as it is the chemist's to provide that knowledge which is to-day transforming our chemical industries. Whether we are building a ship, manufacturing a dyestuff, painting a picture, or writing a book, we should be guided by definite knowledge of the elemental things with which we have to deal and of the ways in which they should be combined.

Synthesis and practical interests.—The examples which have been chosen to illustrate psychological synthesis may seem trivial. They are not, for no point in which man gains control over himself or over his environment is trivial. However slight the importance of a certain bit of physical or psychological information may appear to-day it may prove of inestimable worth to-morrow.

After all, it is by a process of synthesis that we aid in developing the mind of the child. Is this being done with

consummate skill and insight to-day? Do we know as much as is necessary about the nature of mind, its composition, its constitution, and the relations of its elements and complexes? Are we seeking certain ends with that definite scientific knowledge of means which alone can enable us to achieve them without waste and without failure? Are we working, as conscious beings, wisely or blindly? There is no doubt about the answer to the questions. We have to dodge the facts in order to say yes.

Why do we study the processes of synthesis which are occurring within and about us.—All the while in our environment and in our bodies objects are being broken into simpler parts and others are being built up from these parts. The plants and animals, for example, which to-morrow will serve as our food, are to-day growing by means of complex processes of chemical synthesis. All the while our concrete experiences are being created by the combining of more or less simple elements of consciousness. Why are we so keenly interested in observing these processes? The question is answered by the single word "control." We seek to understand the ways in which things grow—the objects of nature not less than our own minds—in order that we may direct the growth process to our satisfaction. Wherever we look we see examples of the practical application of such knowledge as has already been acquired. Races of plants and animals are improved by human skill. Our enjoyment of life is increased by the control of the conditions of æsthetic experience. Indeed, it is only as we become the masters of the synthetic process in the physical or in the psychological sciences that we are able to direct the course of events for our convenience and welfare.

CLASS EXERCISE

Self-observation. The analytic and synthetic study of the consciousness of (a) lemonade, (b) ginger-ale, (c) horse-radish.

Materials: paper, pen or pencil, and some one or all of the substances mentioned. This exercise should be performed out of class and the written reports should be brought to the classroom as bases for the discussion of the task.

First, analyze carefully and deliberately the perceptual consciousness of lemonade (either of the other substances will serve equally well). After as many as are discoverable of the constituent elements of the consciousness have been noted, the attempt to isolate one or another of the factors from the others may be made. Thus, lemon juice without sugar will furnish an experience lacking the element of sweetness. It may prove possible also to isolate the sensation of warmth or of coolness.

This exercise is likely to prove especially interesting and valuable in connection with the reading of Professor Bentley's discussion of "The Synthetic Experiment."

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CHAPTER IX

SENSATIONS AS ELEMENTS OF CONSCIOUSNESS

"I was once without the sense of smell and taste for several days. It seemed incredible, this utter detachment from odors, to breathe the air in and observe never a single scent. The feeling was probably similar, though less in degree, to that of one who first loses sight and can not but expect to see the light again any day, any minute. I knew I should smell again some time. Still, after the wonder had passed off, a loneliness crept over me as vast as the air whose myriad odors I missed. The multitudinous subtle delights that smell makes mine became for a time wistful memories. When I recovered the lost sense, my heart bounded with gladness."

"I am sure that if a fairy bade me choose between the sense of sight and that of touch, I would not part with the warm, endearing contact of human hands or the wealth of form, the mobility and fullness that press into my palms."—These are the words of an observer who lacks sight and hearing.—Keller, Helen: The world I live in, pp. 78, 83.

Simple psychological phenomena.—According to the opinions of a number of competent psychologists there are two, and only two, great classes of simple or elementary psychical phenomena. They are sensations and affections. For the present we may accept this opinion as ours and give our attention to the study of these varieties of consciousness. In so doing we must ever be mindful that both simple sensations and affections are products of analysis, not concrete experiences.

A sensation is a simple fact of consciousness which is referred to some definite bodily organ—its sense organ. An affection, on the contrary, is a simple fact of consciousness which is not referred to a particular organ, but, instead, is pervasive of the whole body.

Rules for the observation of sensations.—Not all sensations can with profit be observed in a given way, but,

all things considered, the following set of rules for their introspection, formulated by Professor Titchener in his "Outline of Psychology," constitutes an admirable guide for the beginner.

Rule 1. When we introspect, we must be absolutely impartial and unprejudiced. We must not let ourselves be biased by any preconceived idea. We are likely to think that, in all probability, a certain thing will happen, or we may actually want to obtain a given result, to confirm some view which we have already formed. In either case, we are in danger of mistaken observation. We ought to be ready to take the facts precisely as they are.

Rule 2. When we introspect, we must have our attention under control. The attention must not be permitted either to flag or to wander.

Rule 3. When we introspect, body and mind must be fresh.

Rule 4. When we introspect, our general disposition, physical and mental, should be favorable. We must feel well, feel comfortable, feel good-tempered, and feel interested in the subject.

These rules are obviously of fundamental importance for all introspection, and not alone for the introspection of sensation.

The five special senses.—Popular opinion has it that there are just five kinds or classes of sensation. These groups are called the special senses of sight, hearing, touch, taste, and smell. They obviously correspond to, and are commonly referred to, the five portions of the body which are popularly recognized as sense organs—the eye, the ear, the skin, the tongue, and the nose. Indeed, it is just because the average person is familiar with only five kinds of receptive organ that he divides sensations into five classes. There are, as a matter of fact, many more than these kinds of sensation. Precisely how many it is impossi-

ble to state, for we can not be sure that our list is complete. In a classification of the sensations which will prove useful to us, Professor Titchener names eight classes in addition to the five " special senses." These additional classes he groups under the heading " organic sensations," as contrasted with " sensations of the special senses."

CLASSIFICATION OF SENSATIONS

I. Sensations of the Special Senses (external stimulus).

1. Visual sensations.
    - a. Sensations of light (stimulus: mixed light).
    - b. Sensations of color (stimulus: homogeneous or pure light).
2. Auditory sensations.
    - a. Sensations of noise (stimulus: sound concussion or shock).
    - b. Sensations of tone (stimulus: sound-wave).
3. Olfactory sensations (stimulus: odorous particles carried by a draught of air).
4. Gustatory sensations (stimulus: the chemical constitution of certain substances, which enables them to excite the organs of taste).
5. Cutaneous sensations.
    - a. Sensations of pressure and pain (stimulus: mechanical affection of cutis and epidermis).
    - b. Sensations of temperature (stimulus: thermal affection of the skin).

II. Organic Sensations (internal stimulus).

6. Muscular sensations (stimulus: contraction of muscles).
7. Tendinous sensations (stimulus: pull or strain upon tendon).
8. Articular sensations (stimulus: rubbing or jamming together of surfaces of joints).
9. Sensations from the alimentary canal.
    - a. From the pharynx (stimulus: dryness of mucous membrane).
    - b. From the œsophagus (stimulus: antiperistaltic reflex).
    - c. From the stomach (stimulus: dryness of gastric mucous membrane).

10. Circulatory sensations (stimulus: change in circulation).
11. Respiratory sensations (stimulus: change in breathing).
12. Sexual sensations (stimulus: change in blood-supply, or in secretory activity, of the sex organs).
13. Sensations of the "static sense" (stimulus: change in the distribution of pressure from the fluid of the semicircular canals of the internal ear).

A "sense" often includes distinct systems of sensation. —As this classification indicates, the word "sense" does not necessarily designate a homogeneous group of sensations. Sight includes two distinct systems, the colorless light sensations, and the color sensations. Hearing, similarly, includes tone sensations and noise sensations; and what is popularly known as touch, really consists of at least four systems of sensation: pressure, pain, warmth, and cold. It will be convenient for us, therefore, to have a name for a group of sensations whose homogeneity separates it from other sensation systems of the same sense. For this purpose the word "mode" seems suitable. We therefore shall speak of a mode of sensation, meaning thereby a group of sensations which differs from other groups psychologically but not necessarily with respect to the organ of sense to which it is referred. Tone sensations, or, better, the mode of tone sensation, are referred to the ear, as are also noise sensations, yet they belong to different systems. To indicate this fact we may speak of two modes of auditory sensations: The tone mode and the noise mode.

A list of the modes of sensation with which psychologists are now familiar would have to include the following groups and systems of sensations:

Achromatic (brightness) sensations
Chromatic (color) sensations
Tone sensations
Noise sensations
Dizziness sensations?
Equilibrational (static sense) sensations

Pressure sensations
Tickle sensations
Sex sensations
Warmth sensations
Cold sensations
Pain sensations (perhaps several modes)
Muscle sensations
Joint sensations
Tendon sensations
Organic sensations (probably many modes)
Taste sensations
Smell sensations

It seems quite improbable that this list is complete. Like the list of the chemical elements, it has been growing for years, and we have no reason to suppose that we have exhausted the possibilities of discovery. At any rate, it will serve to indicate that *the five special senses include only a few of our important modes of sense.*

Sensation, sense organ, and stimulus.—Sensations are always referred to particular organs which are brought into action by disturbances without or within the organism. These disturbances are called stimuli, and the sense organs, because of their capacity to receive stimuli and to respond by certain activities, are called receptors. The physiologist, in order to avoid the implication of consciousness, speaks of photo-receptors, instead of eyes; of chemo-receptors, instead of noses or tongues. With the stimuli which operate upon sense organs, physics is concerned, for they are modes of energy and must be studied as such. With the sense organs to which sensations are referred, anatomy and physiology are concerned, for they are bodily structures whose form and function demand investigation. With sensations, psychology is concerned, for they are elements of consciousness.

Ways of classifying sensations.—There are three important ways of arranging or classifying sensations. They are (1) according to their degree of psychological likeness, (2) according to the bodily organs (sense organs) to which they are referred, and (3) according to the kind of stimulus which gives rise to them.

Of these three commonly used methods of grouping sensations, the first is by all means the most valuable for strictly psychological purposes since it takes account of psychological peculiarities of the things which are to be classified. It leads us to place color sensations together and to separate them from all other sensations. It leads us also to place touch sensations in a different group from that in which we place tickle sensations.

The second method is, however, more widely used aside from psychological studies. It is the basis of the groups which are known as the "special senses." There are in fact just five kinds of sense organs which force themselves upon the attention of the ordinary observer. These are the eyes, the ears, the touch organs (fingers, lips, etc.), the nose, and the tongue. Unfortunately for the value of this method, there are a great many kinds of organs which can not readily be seen. It is the overlooking of these organs which is responsible for the erroneous belief that we have only five senses.

Classification according to the kind of stimulus which arouses sensations is valuable psychologically, for it brings into clear light the fact that each kind of sense organ is adapted especially well for the reception of a certain kind of stimulus. The eye, for example, responds most normally to light; the ear to air vibrations; the nose to chemical action on its membranes; the pressure organs to mechanical disturbances about them; and the temperature organs to changes in the temperature of their surroundings.

There are only a few large classes of sensations, but there are many distinguishable sensation-elements in consciousness.—It is estimated that the normal human being experiences at least fifty thousand different sensations. Of visual sensations alone there are almost forty thousand, and of auditory sensations there are more than ten thousand. For this reason it is quite impossible for

us to attach a name to each particular kind of sensation. Instead, we arrange them after the manner described above and content ourselves with names for the groups of elements. Doubtless as the science of psychology progresses these groups will be broken up more and more because of the discovery of peculiarities which were at first overlooked.

A list of human sense organs, with their corresponding stimuli, their sense modes, and the number of qualities of sensation in each

SENSE ORGAN	STIMULUS	MODES OF SENSATION	NUMBER OF QUALITIES
Eye (Retina)	Light: mixed wave-lengths in ether	Acromatic or white light mode	600—700
	Light: homogeneous waves in ether	Chromatic or color light mode	32,000—36,000
Ear (Cochlea)	Air vibrations	Tone mode	11,000—12,000
	Air concussions	Noise mode	500—600
Ear (Cristæ of canals)	Movements of fluid in canals	Dizziness mode ?	1—?
Ear (Maculæ of sacs)	Movements of fluid in sacs	Vestibular mode?	1—?
Nose (Olfactory cells)	Chemical action	Smell mode	9 classes, each of which contains hundreds of qualities
Tongue (Gustatory cells)	Chemical action	Taste mode	4—?
Skin (Hair bulbs and corpuscles of Meissner)	Mechanical disturbances (Touch, pressure, etc.)	Pressure mode	1—?
Skin (Corpuscles of Ruffini)	High temperatures	Warmth mode	1—?
Skin (Bulbs of Krause)	Low temperatures	Cold mode	1—?
Skin (Free nerve endings)	Mechanical, thermal, electrical, chemical	Pain mode	1—?
Skin and muscle (?)	Mechanical disturbances (slight)	Tickle mode	1—?

SENSE ORGAN	STIMULUS	MODES OF SENSATION	NUMBER OF QUALITIES
Muscles (Fascial corpuscles and muscle spindles)	Mechanical and chemical	Muscular mode	2—?
Tendons (Spindles of Golgi)	Mechanical and chemical	Tendinous mode	1—?
Joints (Sensory corpuscles)	Mechanical	Articular mode	1—?
Internal organs			
Digestive system	Mechanical	Probably no new mode	3—?
Circulatory system	Mechanical and chemical	Probably no new mode	1—?
Respiratory system	Mechanical and chemical	Probably no new mode	1—?
Urino-genital system	Mechanical and chemical	Probably no new mode	1—?
Subcutaneous tissues (Pacinian corpuscles)	Mechanical	Pressure mode	1—?

Animals differ in respect to their senses.—Some kinds of animals have few senses, some have many. Some are strikingly like man in sensibility, others are as strikingly different. The dog, like the human being, has a sense of smell, but it is extremely different from the human sense in degree of development. Indeed, so acute is olfactory sensibility in this animal that psychologists have thus far found no way to study it. The dog's sense of sight also is markedly different from man's, for it apparently does not include color vision. Certain animals, like the lobster and the crab, lack hearing. They are sensitive to slight jars and vibrations in the surface upon which they rest, but they utterly lack what we understand by sensations of sound. On the other hand, there is excellent reason to believe that there are animals in which senses exist of which we have no knowledge. How else are we to explain to ourselves the remarkable ability of certain beings to find

their way home or to make long migratory journeys? We must not permit ourselves the thought that all animals experience the same sensations, or even that they possess the same modes of sense.

Even human beings differ importantly with regard to the number and characteristics of their sensations.— The color-blind individual is not a rarity, and partial or total deafness occurs frequently. Those exceptional individuals who wholly lack such senses as sight, hearing, taste, smell, or the several modes of sense of the skin, necessarily live in a world of their own. They learn to recognize things in ways which are strange to us. They become proficient in the use of the receptive organs which they happen to have at command. To an almost incredible extent the organs of touch and smell may be made to do the duty of sight. This the statements of Miss Helen Keller prove. But hearing too may bear its share of the burden and its great acuteness often goes far toward compensating for total blindness.

CLASS EXERCISE

Self-observation. The upper limit of hearing. Materials: Galton whistle (either the ordinary type or the Edlemann modification), paper, and pen or pencil.

In preparation for this exercise, each student should write in the left margin of a sheet of paper the numbers in order from 1 to 20. With the whistle, the instructor—who will act as experimenter for the class—produces in succession tones differing in pitch. He may either follow the plan here suggested, or better, he may arrange a series of stimuli to suit the circumstances of the exercise.

SUGGESTED PLAN

Number of test	Result: heard or not heard	Vibration rate or pitch of tone
1	Yes = heard	10,000 complete vibrations
2	"	14,000 " "
3	"	16,000 " "
4	"	18,000 " "
5	"	20,000 " "
6	"	21,000 " "

and so on, by steps of 1,000 vibrations to 30,000.

Each time, immediately after the sounding of the whistle, the student should record on his record sheet whether or not he heard the tone. It is important that he early learn to distinguish between the hiss of the air escaping from the whistle and the tone, and it is also important that he attempt to describe the various tones in terms of their peculiarities.

If time permits, the order of the tests may be reversed and, beginning with a tone whose pitch is too high to be heard, the experimenter may produce with the whistle lower and lower tones, until finally a point is reached at which all members of the group clearly recognize the tone.

At the conclusion of the exercise, the results may be handed to some member of the class for special study and report. Such a general report should embody the results of reading on the special topic of the upper limit of hearing as well as a statement of the general results of the class experiment.

As references for further information may be mentioned: Myers, C. S., "Text-book of Experimental Psychology," p. 36; Galton, Francis, "Inquiries into Human Faculty," pp. 26, 252; Titchener, E. B., "Experimental Psychology," vol. 2, part 2, p. 41 ff.

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CHAPTER X

THE PROPERTIES OF SENSATIONS

"We call the reverberations of a thunderstorm more voluminous than the squeaking of a slate-pencil; the entrance into a warm bath gives our skin a more massive feeling than the prick of a pin; a little neuralgic pain, fine as a cobweb, in the face seems less extensive than the heavy soreness of a boil or the vast discomfort of a colic or a lumbago; and a solitary star looks smaller than the noonday sky. . . .

"In the sensations of smell and taste this element [property] of varying vastness seems less prominent but not altogether absent. Some tastes and smells appear less extensive than complex flavors, like that of roast meat or plum pudding, on the one hand, or heavy odors like musk or tuberose, on the other. The epithet *sharp* given to the acid class would seem to show that to the popular mind there is something narrow and, as it were, streaky, in the impression they make, other flavors and odors being bigger and rounder."—JAMES, WM.: Principles of psychology, vol. 2, pp. 134, 135.

The properties, characteristics, or attributes of things.—All objects, whether they be physical or psychical, possess properties, or, rather, are constituted by a certain group of properties. A property may, for our purposes, be defined as a way in which an object behaves. We call an object red if it behaves in a certain way with respect to light. We call it hard if it behaves in a certain way when touched. We call it brittle, explosive, inflammable, according to its behavior. Molecules, crystals, flowers, birds, and also psychic objects such as sensations and affections are distinguished from one another by their different properties. It shall be our task in this chapter to examine into the number and nature of the properties of sensations.

There are two classes of properties belonging to sensations: the common and the particular.—Certain properties are possessed by all sensations. These we call common

or essential properties. Others, which we may call particular or accidental, belong to only a few or to a single sensation. Misunderstandings have arisen because many text-books of psychology present lists of the common properties of sensations without emphasizing the fact that every sensation possesses a great many other properties which are not common to all sensations.

Common properties of sensations enumerated by different psychologists.—

WUNDT	MÜNSTERBERG	TITCHENER	ANGELL	BALDWIN
Quality	Quality	Quality	Quality	Quality
Intensity	Intensity	Intensity	Intensity	Quantity
——	Vividness	Clearness	——	——
——	Value	——	——	Tone
——	——	Duration	Duration	Duration
——	——	——	Extensity	——

Comparison of these several lists yields a total of six different properties. They are quality, intensity (or quantity), clearness (or vividness), duration, extensity, and value (or tone). The use of different terms to designate the same psychological facts is an annoying practice in psychology and one which should as rapidly as possible be corrected by the adoption of a certain system of terms.

From the above lists, which are fairly representative of psychological opinion, we discover that quality is a characteristic of sensation generally accepted and by right of importance placed at the head of the list. Intensity also is universally accepted and ranked next in importance to quality. The other characteristics are of less importance

and their number varies according to the theoretical views of the individual psychologist as well as with his introspective ability and experience.

Certain sensations have clearness, duration, extensity (called voluminousness by Professor James), and value. The pertinent question is, do these properties belong in the same class with quality and intensity by virtue of the fact that they are common to all sensations? At this point it should be noted that Professor Münsterberg and Professor Baldwin include in their lists an attribute (value or feeling-tone) which is missing from all the other lists. This means that they believe that each sensation has a certain feeling-tone or value, and is, necessarily, more or less agreeable or disagreeable. Other psychologists, and they appear now to be in the majority, believe, on the contrary, that feeling-tone is really an element of consciousness instead of an attribute of sensations.

Quality is the property by means of which we recognize and name sensations.—Quality is to sensation what expression is to the human face. But for it and its variety our sense experience would be monotonous. We experience thousands of qualitatively different sensations daily. A sensation of color differs from a sensation of taste first of all in quality. A sensation of red differs from a sensation of green primarily in quality. One sensation of red may differ from another sensation of red merely in quality, yet psychologically they may be as different as night is from day. All other characteristics remaining the same, we readily distinguish sensations of diverse quality. No wonder then that introspection forces us to place quality at the head of the list of the attributes of sensation.

It is quality which gives its name to a sensation. Red, as a name for a sense-element, designates not a single quality but a group of qualities, for there are many qualitatively different sensations of redness. Pain, likewise, designates

not a single sensation, but a class of pain qualities. And so it is throughout our list of words for sensations. We have names not for particular qualities but for classes of qualities. These classes we have above proposed to call sense modes. A single " mode of sense " may include a dozen, a hundred, or thousands of qualities, and a " sense " always includes a large number of different qualities. The sense of sight, for instance, includes hundreds of qualities of light sensations and thousands of color sensations, so that together there are several thousands of visual sensations.

Quality is the most interesting characteristic of sensations, yet it alone does not enable us to describe a sensation-element satisfactorily. As well might the chemist claim to have completed his account of a chemical element after stating its atomic weight as might the psychologist consider his task finished after the quality of a sensation has been named.

We describe things by pointing out as many of their characteristics as we can discover. The newly discovered metal has a score of attributes which are of value. So has the newly discovered sensation. In emphasizing the importance of quality we must not lose sight of the value of the other characteristics of sensations.

Every sensation has intensity.—Intensity is but another name for the quantity of sensation per unit of time. It has nothing to do directly with duration or quality. A sour taste may be weak or strong; of slight or of great intensity. Indeed, we are able to measure the intensity of sensations by taking account of the number of steps by which one differs from another. Two sensations of the same quality may yet be readily distinguishable by reason of difference in intensity. A sensation of tone may be varied in intensity from its faintest perceivable condition to a loudness which can not be exceeded. Between these

two points there are hundreds of intensities which can be distinguished. It requires some introspective care to avoid confusing qualitative with intensive differences, for when there are great differences in the intensity of two colors, or lights, or sounds, or tastes it may at first seem as though the two differed in quality.

Every sensation has clearness.—Each of us has experienced pains which were surprisingly mild and unobtrusive. A cut, or burn, or bruise has caused us almost no annoyance because we were occupied fully with some task and we had no time to attend to it. A sound from the street has come to us faintly not because it was faint but because we were occupied. Evidently clearness is not the same as intensity either psychologically or physiologically. Two sensations of precisely the same quality and intensity may yet seem quite different, and they may not be recognized as identical in these characteristics, because of difference in clearness.

Concerning this property of sensation Professor Münsterberg writes, "Vividness is not identical with intensity; the vivid impression of a weak sound and the faint impression of a strong sound are in no way interchangeable. If the ticking of a clock in my room becomes less and less vivid for me the more I become absorbed in my work, till it finally disappears, it can not be compared with the experience which results when the clock to which I give my full attention is carried farther and farther away. The white impression, when it loses vividness, does not become gray and finally black, nor the large size small, nor the hot lukewarm." (Münsterberg, Hugo: Psychology and Life, p. 86.)

Every sensation has duration.—A sensation which does not last for at least an instant is inconceivable. With respect to the length of time which they remain with us sensations differ rather markedly. Among the pain sensations some are momentary thrills or throbs, others are persistent

dull aches. Some flash through consciousness, and others enter and leave it slowly. Here, then, we seem to have an additional characteristic by which it should be possible to distinguish sensations or, at least, to perfect our description. We should measure with all attainable accuracy the duration of each mode of sensation, and of such qualities within a mode as vary in this respect, and we should then use the available facts for descriptive purposes. Such rough statements as those we are accustomed to hear and to make with reference to the length of life of a sensation are far from satisfying to the scientific mind. We must know accurately the duration of each kind of sensation. It is not sufficient that we know pressure sensation to be of greater duration, as a rule, than color sensation. Our knowledge must be rendered precise, if the characteristics of sensations are to be made valuable in description.

Many, if not all sensations, possess a certain extensity or voluminousness.—Professor James has thus stated the facts of introspection: "In the sensations of hearing, touch, sight, and pain we are accustomed to distinguish from among the other elements (or characteristics) the element of voluminousness." The sound of a croaking frog is vastly more voluminous than that of a shrill whistle. In fact, low tones or deep noises are as a rule more extensive than high tones or piercing noises. Languages indicate this fact by characterizing sensations as dull, deep, piercing, penetrating, flat, sharp, cutting. The difference between the lowest audible tone of a tuning fork and the highest audible tone is not merely one of quality or even one of intensity, of clearness, or of duration, for there is a voluminousness about the low tone which is in marked contrast with the small extent of the high tone. The former seems to be massive and spread out; the latter seems sharp and it has an effect which is best described as cutting.

Again, two pain sensations are often readily distinguishable by their extensity: the one is all pervasive, the other narrowly limited. And this has reference not to the amount of the body stimulated, but instead to our consciousness of the size of the sensation itself. Professor James has picked out those senses in which voluminousness is most striking. Surely we have in extensity still another characteristic of sensations which is worthy of careful investigation and accurate measurement.

The value or feeling-tone of sensations.—Many sensations are accompanied by a feeling- or affective-tone which seems to be a characteristic of the sensation itself. Evidently there are two possibilities: either this feeling may be an element of consciousness which accompanies certain sensations, or it may be an aspect or property of the sensation itself. At present the facts of introspection do not enable us to decide with certainty which is the case. It may prove to be true that there are independent "sense-feelings," as Professor Wundt calls them, which sometimes accompany sensations, and also that there is an affective-tone which is a characteristic or property of the sensations. The best we can do is to note that some sensations feel agreeable, some disagreeable, and others indifferent. It is the business of the psychologist to study this aspect of sensation with such care as to discover definitely whether or not sensations possess the attribute of feeling-tone.

Are there other characteristics of sensation?—Yes, the particular. In the opinion of the writer, it is just as misleading to state that there are two, three, or four properties of sensation as it is to contend that there are but five special senses. As a fact there is an indefinite number of properties, attributes, or characteristics, only a few of which are common to all sensations.

Of the many particular or accidental properties of sensations, only a few are mentioned in psychological text-books.

Many of them, in fact, are not sufficiently well known in introspection to justify attempts at description. But far more unfortunate than this gap in our knowledge of the particular characteristics of sensations is the fact that many psychologies lead their readers to infer that quality and intensity together with two or three other attributes are the sole properties of sensations. It is manifestly unwise for a psychologist to set a limit to the number of characteristics which a sensation, or any other consciousness, may possess. As well might the physicist attempt to set a limit to the number of possible characteristics, attributes, or properties of a flying-machine, or the biologist maintain that protoplasm has four and only four properties

We should study the particular as well as the common properties of sensations.—Instead of limiting ourselves to a study of the common properties of sensations, we should strive to discover as much as possible about their nature and relations. As the astronomer studies the heavenly bodies in order to learn all that he can about their behavior, so the psychologist should study sensations in order to learn as completely as he can what may be expected of them. There are innumerable conditions or respects in which a sensation may be tested, and each exhibits a new property of the phenomenon. Who shall say how many important particular properties we may discover if we persistently examine our sensations?

A partial list of the facts about sensations which are observable.—It is to be remembered that this list is avowedly incomplete, and that it should be the task of every reader to add to it.

We may study any simple sensation in order to get information concerning:

(1) *The threshold.*—There is a minimal sensation for every " mode " and " quality " of sense. Is this least of sensations of the same size for all the modes and qualities?

Does it bear the same relation to the physical stimulus and to the activity of the sense organ in each case? Is the amount of energy expended by the nervous system (sense organ) in connection with a minimal or threshold sensation always the same? These are psycho-physical problems, but they throw an important light upon one characteristic of a sensation. The threshold is really the minimal intensity of a sensation, but we can not on that account say that it is not a characteristic, for it may turn out that there are characteristic differences in the thresholds of different modes and qualities of sensation. Here research is imperative.

(2) *The maximum.*—There is also a maximal sensation for each quality. It is at the opposite extreme from the threshold. The minimal and the maximal sensations represent the intensity limits of a given quality. Supposing that here again the maximum is characteristic of the quality under consideration, it is evident that it should be considered a particular characteristic of the sensation.

(3) *The threshold of difference for a sensation.*—It is legitimate to ask by how much a given sensation must be increased or decreased in intensity or changed in quality in order that it shall be perceived as different. Provided this amount proves to be characteristic of the mode or quality, it may properly be spoken of as a characteristic of the sensation.

(4) *The position of a sensation in the intensity series.*—Whether a given sensation lies near the minimal or near the maximal sensations of its series may seem unimportant, but for certain purposes this information is invaluable. And it has a right to the title of characteristic, for it aids us in so describing a sensation that it may be identified with certainty. Although this simple fact of position or relation to other members of the intensity series evidently has refer-

ence to the attribute of intensity, it is different from the property of intensity.

(5) *Time of development.*—Some sensations gradually and slowly push their way into consciousness; others shoot in. There is a period of increase, a period of maximal presence, and a period of waning. The length or duration of each of these periods may be characteristic of a given sense mode or quality. If we were seeking merely to string out the characteristics of sensations to their greatest length, we should speak of these as three separate characteristics. For as a fact we have to determine separately (a) the length of time during which the sensation waxes in prominence, (b) the length of time during which it is at its maximum, and (c) the length of time during which it passes from the maximum to the vanishing point. How important these three facts concerning sensations may prove to be, later in the development of our science, no one can safely predict. Our clear duty is to collect the facts in order to use them as may prove needful later.

(6) *Facts about clearness.*—The property of clearness, as contrasted with intensity, is dependent upon the relation of the simple sensation to other contents of consciousness. An intense sensation may be unclear; and a weak sensation may be clear. But aside from this fact, it may be that certain sensations are prepotent over others, because of natural clearness. If we think of each quality of sensation as having a number of distinguishable grades of clearness, then some qualities may have fewer of these grades than others, some may go further than others in the direction of diminishing clearness, and others may go furthest in the direction of increasing clearness. The property of clearness in the case of a given sensation might profitably be studied (a) with respect to the minimal clearness discoverable, (b) with respect to the maximal clearness, (c) with respect to the number of distinguishable grades of

clearness between the extremes, and (d) with respect to the relation of the several facts of clearness to intensity.

(7) *Relations to other sensations.*—Every sensation has a multitude of properties of relation to other elements of consciousness. Gold differs from platinum in its capacity to combine with chlorine. A sensation of color differs from a sensation of taste in its capacity to combine with a sensation of light. Yet each of these characteristic capacities or properties is truly an attribute of the objects, and valuable to him who wishes to describe them.

In studying a sensation we seek to learn all we can about it.—Although our first task in studying the psychology of sensation is to observe the characteristics of the several sense modes and the existence of qualities, it should be our aim to learn all that we can about the sensation as a psychological object rather than merely to note the existence of certain characteristics. No preconceived ideas should hamper our observation and no limitations should be set to the number of facts which may be discovered.

Introspective accounts of high and low tones of different timbre.—From student's reports the following descriptions of relatively simple auditory experiences are quoted to illustrate methods of describing introspections and individual differences in consciousness.

The tones referred to are a Stern variator tone of 300 complete vibrations per second (low tone) and a Galton whistle tone of 12,000 complete vibrations per second (high tone); and the tones of two Koenig tuning forks, the one of 870 complete vibrations per second (low tone), and the other of 2,560 complete vibrations per second (high tone).

First observer.—"The variator tone seems cool, deep, wide. I do not know whether it is correct to use these adjectives of a sound, but they are precisely the ones the tone suggests. It is also distant, as though coming from outside the room, and rather pleasant. The whistle tone gives me

a prickling sensation. Every time it is repeated a needle point seems to touch my ear drum. The sound seems to be inside the head; certainly not from the desk.

"The tone from the 870 vibration Koenig fork is to me soft, pleasant. The tone from the 2,560 vibration fork suggests a yellowish flash, and it is at the same time so sweet that it almost brings a perfume. I wish I could explain this. I have two distinct impressions as the tone reaches me. I can recall each of these tones as distinctly afterward as when they are sounded. After ten minutes I still can hear them without making an effort to do so. They are in my ears."

Second observer.—"The sound of the variator is pleasing and soothing. It is like passing the hand over satin; or looking out on a starlight night. It seems, too, far away, as though a memory of something heard years before. If a sound has size or shape, this must be broad and convex, with no corners.

"The tone of the whistle seems not so much a sound; it is more like a hat-pin thrust into me full length. I shrink from it as though the contact were really tactual. It is like a bright electric light suddenly flashed into the eyes.

"The fork of higher pitch produces a more immediate effect and it seems nearer than the lower tone. But its effect is not so lasting. It does not call up so many associations as the lower tone. The higher tone seems to occupy less space. It is something like a narrow band; while the lower tone is an expanse without boundaries."

Third observer.—"The sound made by the Galton whistle is high and sharp. It is of shorter duration than the tone of the variator, and it ends slowly with a lowering of pitch. The variator's tone is, however, more agreeable than the sound of the whistle. The whistle tone is like the cry of a mouse; that of the variator is like a locomotive at night

two miles down the track. The sound of the whistle seems pink, that of the variator seems blue-black.

"The tone of the 870 vibration tuning fork is gray-blue; that of the 2,560 vibration fork is yellow. The higher of the tones also seems to have a metallic quality which is entirely lacking in the lower.

"I could reproduce the sound of the Galton whistle and the low tone of the variator by recalling the squeak of a mouse and the shriek of a locomotive whistle."

CLASS EXERCISE

Self-observation. The properties of sensations of sound. Materials: paper and pen or pencil, Galton whistle, tuning forks, steel rods, or any instrument or instruments by means of which tones differing markedly in pitch, in quality, and in both respects simultaneously, may be produced. For this exercise special experimental apparatus is not more valuable than musical instruments. Every instructor will find it easy to provide suitable materials.

The class may be asked to observe and carefully describe sound experiences with respect to the following characteristics: (1) Quality. A low and a high tone are sounded in quick succession. How do they differ psychologically? (2) Intensity. A faint and a loud sound are produced in succession. Describe the differences in their effects upon you? Can you readily distinguish differences in pitch from differences in intensity? In pitch sounds are high or low; in intensity they are loud or faint. (3) Clearness. Let the same sound be heard once without accompanying distracting visual stimuli (such, for example, as the writing of the name of the instrument and the pitch of the tone on the blackboard while the sound is being produced) and again with this visual distraction. Compare the two experiences of sound. Are they equally clear or vivid? This experiment may have to be repeated several times with slight variations before all members of the class are enabled to note degrees of clearness in their sensations. (4) Duration. With the Galton whistle two tones, the one relatively low and the other high, are produced. Do the sensations last equally long? Is duration dependent upon the quality or the intensity of a tone? (5) Affective-tone.

Are the different tones which you have heard equally agreeable? Compare tones differing in pitch, those differing in loudness, and finally those produced by various instruments.

Which of the attributes of auditory sensations observed are essential or common, and which are accidental or particular? Make a list of the properties of sensations of sound observed by you.

SUPPLEMENTARY READING

Titchener, E. B.: Text-book of psychology, §§ 10-13.
Münsterberg, Hugo: Psychology and life, chapter on "Psychology and physiology."
Angell, J. R.: Psychology, pp. 145-148.

CHAPTER XI

THE SENSATIONS OF SIGHT AND HEARING

"If it is vacation time and I am digging in my garden and a neighbor leans over the fence and says, 'What do you think of James?' I shall probably think, 'What James?' If I were in a class-room in the university and a student asked the same question, I should think of the gifts and work of the eminent psychologist.

"The same thought may arouse different associates according to whether it is felt in one's work system or play system; one's week-day or Sunday system; at home or at school; by one's self or among others; in one's scientific or one's sentimental system; in the mood of elation or of depression. . . . Notice how every new thought in the following reverie is due, not to the previous thought alone, but also to the general system of 'African war affairs':

"Sensations of getting warm under sun while walking fast. Soldiers in Africa compared with me. My bag not like soldier's gun but officer's sword. Officers do not wear swords, but I saw a picture of one with a scabbard recently. British have learned a lot in this war. Boers taught officers to quit wearing swords by shooting at officers. Old chivalric notions dying out of warfare; thought of Fontenoy and the silly exchange of courtesies. Newspaper tale that Roberts has society men on his staff as well as real men. Does he have to? That's why he keeps ahead of Kitchener, by not appearing harsh. What's Kitchener doing as chief of staff? Roberts sending him to relieve Rushenburg, something like sending him to the Victoria West District. I guess they work separately better than together. I would better think of something useful. I'll work up this train of thought."—THORNDIKE, E. L.: Elements of psychology, pp. 248, 249.

The psychology, as contrasted with the physics and physiology, of the senses.—In the few brief chapters which can be devoted in this book to sensation, attention is directed solely to the psychological properties and peculiarities of sense qualities. Departing from the custom in connection with outlines of psychology, I have chosen to use all of the available space for this strictly psychological task, instead of giving a portion of it to a consideration of the physical characteristics of the stimulus, and to the nature

of the physiological processes which occur in the body in connection with sensations. This has been done not because the facts of physics and physiology are lacking in importance, or even because they are less important than the matters which are discussed, but simply because *this is a text-book of psychology, whose primary purpose is to teach self-observation through the study of the problems, methods, facts, and principles of the science of mental life.*

Certainly every one should know much about the physical conditions of life and about the vital processes themselves, but surely this information should not be imparted in a course in psychology at the expense of the study of consciousness. It is as unfair to teach physics and anatomy and physiology under the guise and in the name of psychology as it is to teach psychology under the guise of any of the physical sciences, for in any case the student gains an incorrect conception of the nature of the science which he supposes he is studying.

Sensations form systems or series.—The sensations of some of the modes of sense which were mentioned in Chapter IX may be arranged in continuous series. This is obviously true of achromatic or white light sensations, for we can pass by steps from white, through light and dark gray, to black. This system of visual sensations is sometimes called the brightness series, but because of the need of the term brightness for other purposes, it seems more desirable to call it the achromatic series. Similarly our tone sensations form a continuous series, from low to high. On the other hand, our smell sensations have thus far remained unclassified. If there are natural series within this mode of sense—and it certainly seems as if there were several—they are strangely difficult to discover.

Again, there are two sorts of series of sensations which are readily observable: the qualitative and the intensive. Our color sensations from red to purple, and thence to red,

constitute a qualitative series. And the various intensities of red, ranging from the threshold sensation of this quality to the maximum sensation, constitute an intensive series. That there are also possible series for other common properties, as well as for certain of the particular properties of sensations, seems highly probable. It would seem, for instance, that there must be a clearness series and a duration series for every quality of sensation. In view of such a possibility the number of series or systems of sensations seems almost hopelessly large, but only a few are well enough known at present to justify description.

The psychology of sensation is a large subject.—In no direction has the science progressed so far or so satisfactorily as in the study of sensation. The text-book writer is therefore forced to choose between devoting a large amount of space to the subject or treating it inadequately in order to have space for other aspects of the science. We shall choose the latter alternative, and by sketching the chief characteristics of this field, we shall attempt to give the beginner a clear knowledge of what sensation is and what the psychologist is trying to do with it. A multitude of facts—important and interesting as they are—we shall pass unmentioned.

VISUAL SENSATIONS

Achromatic, or white light, sensations.—There are two chief systems of visual sensations: the achromatic or white light, and the chromatic, or color, sensations. Whites, grays, and blacks belong to the former; reds, blues, greens, etc., to the latter. We shall now examine the peculiarities of the achromatic sensations.

Between the whitest white and the blackest black of human experience there are from six to seven hundred different sensations. These sensations constitute the white light series. As there are degrees of sweetness, sourness,

or pain, so there are degrees of whiteness and blackness and grayness. An extremely black sensation may be obtained by looking into a perfectly light-tight box through a small hole, and similarly a white sensation which makes that obtained from white paper seem gray in comparison may be obtained by looking at a good reflecting surface—a bit of silvered glass or a highly polished piece of metal—upon which direct sunlight is falling.

Thus far, the achromatic sensation series appears to be one dimensional, and it may be graphically represented by a straight line, upon which dots stand for the several qualities of black, gray, or white. Now, it is important that we should know not only how many distinguishable sensations of white light there are, but also how this fact may be determined.

Methods of discovering how many sensations of colorless light one experiences.—One of the simplest ways of discovering how many sensations of this sort a particular person can experience is the following: Take two discs of cardboard, the one very white and the other dull black, make a small hole in the center of each and then slit each along a radius from edge to center. Divide the circumference of the discs into degrees and mark them plainly on the back. The two discs may now be interlocked, and the amount of white or black surface which is visible may be varied at the will of the experimenter. By referring to the scale of degrees on the back of the discs it is easy to read off the proportion of each which is exposed to the view of the observer as he stands in front of the discs. A second pair of discs should now be made. Next, the pairs may be placed on a double color wheel and rotated rapidly. If the black disc is covered by a considerable width of the white disc, the rapidly moving surface will appear gray instead of either white or black. The question to be answered by the observer is by how much must the one black disc be lightened by the addition of white in

order that it shall seem just perceivably different from the other black disc. This may be determined by rotating the pure black side by side with a black to which a small amount of white has been added. The observer determines just how much white is necessary to render the new sensation distinguishable from the original black. This gives the first step toward white. Then to the pure black disc white is added until it, in turn, seems just noticeably lighter than the gray of the other disc. Thus the second step toward white is taken. With patience the whole distance between dead black and intense white may thus be traversed and the exact number of sensation qualities in the achromatic series determined.

Another method of solving the problem is to arrange two small openings or windows beside one another in a perfectly dark room, each covered with opal flashed glass which can be illuminated from the side opposite the observer. The observer sits in the dark room looking at the two windows while an experimenter gradually increases the amount of light coming through one of the windows until it is just perceptible. The observer then stops him by stating that one window looks lighter than the other. Next the experimenter illuminates the other window until it is just appreciably lighter than the first. And so on, step by step, advance is made from utter blackness to the extreme of whiteness. During this process the experimenter carefully measures the intensity of the light each time a change is made and keeps a record of the number of distinguishable sensations.

Do achromatic sensations differ only in intensity or also in quality?—This question is difficult, and introspection has led skilled observers to widely differing answers. Professor Wundt states that the series is intensive merely. In his opinion white differs from black, or light gray from dark gray, only in that the one sensation is more intense than the other. Professor Titchener, on the contrary, be-

lieves that the series is both qualitative and intensive. One sensation of gray may differ from another sensation of gray in two preëminently important characteristics: it may be lighter (or darker), and it may at the same time be brighter (or duller). This leads Professor Titchener to describe the achromatic series of sensations as varying in two dimensions, instead of in one as Professor Wundt maintains. These two dimensions are named the lighter-darker and the brighter-duller. The facts may readily be represented diagramatically as follows: Professor Wundt's conception of the relations of the sensations obviously demands only a straight line as a means of representation, while Professor Titchener's would seem to demand a two dimensional figure (plane).

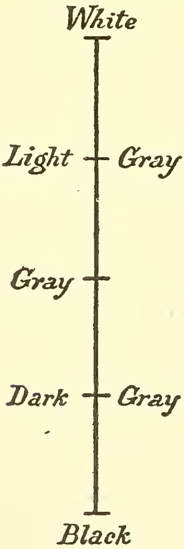

FIG. 1. The system of light sensations.

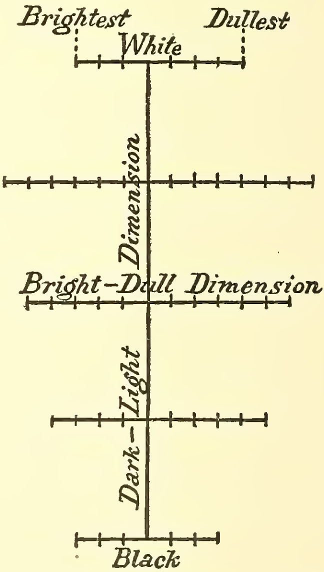

FIG. 2. The two dimensions of light sensations: the brighter-duller and the lighter-darker.

As a matter of fact, Professor Titchener insists that every considerable change in the brightness of a sensation involves also a change in lightness. Consequently the two dimensions tend to merge into one. The writer, entirely on his own responsibility, presents Fig. 2 as a diagrammatic representation of the system of achromatic sensations. There can be no doubt that any considerable change in brightness is impossible without a change in lightness, but there nevertheless appear to be a number of distinguishable brightnesses for each particular quality of lightness.

Tasks for introspection in connection with achromatic sensations.—In view of the above facts, it is clear that our first task is to determine by self-observation whether our colorless light sensations differ from one another in the two distinguishable properties or attributes to which the names lightness and brightness have been given. It is easy enough to note that the white of this paper is lighter than that of another. Is it, at the same time, brighter? Without accepting as final the statements of either of the authorities cited, we should put this matter to the test of introspection.

Our second task, as observers of the nature of sensations of colorless light, is to determine the number of brighter-duller sensations which exist for a given quality of lightness. To be sure, the possibility of doing this depends upon the nature of our solution of the first problem, for unless sensations are brighter-duller, as well as lighter-darker, it would have no meaning to ask how many degrees of brightness exist for the observer. Supposing, however, that the writer's introspective results be verified, then, it is clear that the exact shape of the plane which should represent our system of achromatic sensations must be determined by careful observation. The procedure would have to be somewhat as follows, we may imagine.

Starting with the experimentally determined fact that

for a given observer six hundred and fifty-four distinguishable qualities of sensation exist between the extremes of white and black, we should erect a vertical line upon which dots should represent each of the six hundred fifty-four light-dark sensations. We should then have to determine by experiments similar to those just described, how many distinguishable degrees of brightness or dullness exist for each of the more than six hundred qualities of lightness. Let us suppose that there proved to be only a few distinguishable degrees of brightness for white and black sensations, and an increasing number for each successive gray as we approach "middle gray." Then it is evident that the plane which would roughly represent these facts is diamond shaped, like that of Fig. 2.

To determine experimentally the number of brightnesses existing in the case of each of six hundred and fifty-four qualities of light sensation would be a tremendous task, but it is precisely such tasks that the real experimental psychologist is eager to undertake.

An estimate of the number of distinguishable achromatic sensations, supposing that lightness and brightness are distinguishable properties of each sensation.— It is fair to ask whether lightness is not a quality of sensation, and brightness an intensive attribute. This would appear to be Professor Titchener's opinion, but he especially emphasizes the fact that the qualitative and intensive attributes of visual sensations are most complexly related. Doubtless it will be easier for us to remember the points which have thus far been made with respect to light sensations, if we think of each of the six hundred and more whites, grays, and blacks as presenting themselves to us in a number of intensities. At any rate, we shall make our imaginary estimate of the total number of distinguishable colorless light sensations on the basis of this assumption.

Let us suppose that ten intensities of the uppermost

quality of white exist between the least (threshold) and the greatest (maximum) degree of brightness. Let us assume also that the corresponding number for the lowermost quality of black is five, while that for the middle gray is fifty. And let us further assume that the average number for all the qualities of light is thirty-two, then the total number of distinguishable sensations represented by the plane (Fig. 2) would be, for the particular observer whose number of qualities is known to be six hundred fifty-four, 32 x 654 or 20,928.

Here is one of many fields of psychological research which is worthy of the most patient and industrious of observers.

Chromatic sensations.—The series of color sensations is closely related to that of colorless light, for every color is more or less light. By means of a prism pure white sunlight may be resolved into the spectrum. This consists of the colors red, orange, yellow, green, blue, and violet. To this list a color must be added which forms the connecting link between red and violet, but which does not exist in the spectrum; it is purple. Our color sensations differ from our achromatic sensations in that they form a closed series, for starting with red, we may return to red through purple. It is not possible to do this in the case of the light sensations, for there is no link connecting black and white. "Let us take, as the arrangement of colors with which we are most familiar, a chart or a projection of the solar spectrum, and let us work through it, from the left or long-wave to the right or short-wave end. On the extreme left we have the quality of red. As we travel to the right, the red takes on more and more of a yellowish tinge, until it passes through orange to a pure yellow. Here, then, we have a linear series of qualities, precisely similar to the series of light sensations. Now, at yellow, we change our direction. The yellow gradually becomes tinged with a new

quality, that of green; it passes through yellow-green to a pure green. Here is a second line of qualities. Again we change our direction; the green becomes more and more bluish, until it passes through blue-green to a pure blue. Here is a third line of qualities. Once more we change our direction. This time, however, the tinge that our initial quality takes on is not new; the blue becomes increasingly reddish, as we travel to the right-hand end of the spectrum. Here is a fourth line of qualities, but a line which in the spectral series is left incomplete at violet. If we continue it by adding the purples and carmines, we are finally brought back to our starting-point,—the red of the extreme left.'' (Titchener, E. B.: Text-book of Psychology, pp. 60-61.)

The number of "colors" popularly so-called and our names for them.—Our color sensations are called hues, colors, or color tones. They number about one hundred and sixty. This fact may be determined most readily by projecting two spectra, the one beside the other, upon the white wall of an otherwise dark room; covering each, with the exception of a narrow line, and then varying the region covered in the case of the one until the line is just noticeably different in color from that of the other. By thus working slowly, and with many repetitions of the observations, throughout the length of the spectrum, it is possible to determine just how many hues or colors—aside from those of purple—are experienced by a given observer.

We are able to distinguish fewer qualities of color than we do qualities of colorless light, and yet we have many more color terms than names for colorless sensations. For the former we have red, orange, pink, scarlet, vermillion, crimson, etc. throughout the series, whereas for the latter we have only black, gray, and white, with variations indicated by light, dark, etc. It would seem, therefore, that our color sensations are either more important or, for some

reason, more interesting to us than our colorless experiences.

Chromatic sensations may differ from one another qualitatively in several respects.—The attribute of quality in the case of achromatic or colorless light sensations appears to be simple, but in the case of chromatic sensations it is complex. The results of psychological analysis at present go to show that every sensation of color possesses at least three qualitative attributes. There is first of all, and most important, the quality of color or color-tone, commonly so-named, or *hue*, as we shall designate it in this book. Thus, blue, green, violet are hues. Secondly, every hue—and as has already been stated, there are some one hundred and sixty of them experienced by the normal adult—possesses the quality of depth or degree of color. This is often spoken of as the saturation of the color. We shall call it the *chroma*. Red, for example, is experienced by us in many different chromas (pink, crimson, etc.). Finally, a color sensation possesses the quality of degree of lightness. It is either lighter or darker than another sensation of the same hue and chroma. For this quality, following Professor Titchener's usage, we shall use the term *tint*, in spite of the fact that it has not commonly been used in this sense. Thus in the terminology used for the Milton Bradley colored papers, we note that tints are the qualities of a color which lie nearer to white and shades those which lie nearer to black.

From the point of view here adopted, no description of a chromatic sensation is qualitatively complete unless it indicates the hue, the chroma, and the tint of the experience.

Intensive, as contrasted with qualitative, differences in sensations of color.—Two sensations of like hue, chroma, and tint (that is, qualitatively identical) yet may differ with respect to their degree of brightness. The one may

be brighter than the other. This attribute, just as in the case of achromatic sensations, we may term the brighter-duller, as distinguished from the lighter-darker, character. The qualitative attribute of degree of lightness (tint of a color) is frequently confused both in observation and in description with the intensive attribute of brightness. As a given sensation of white may be lighter than another quality of white and at the same time duller, so a given sensation of color may be lighter (of higher tint) than another and at the same time duller (less bright).

How may our system, or systems, of color sensations be represented graphically?—Evidently this system is too complex to be represented by a straight line, or by a plane figure, as is the achromatic series.

It has been discovered that a double pyramid, like that of Fig. 3, serves to represent all of the qualities of our color sensations, and those of our colorless light sensations as well. The manner of this representation is admirably described by Professor Titchener: "At the two poles [white and black of the figure] stand the extremes of white and black; upon the vertical axis, between the poles, are arranged the remaining sensations of light. Round the base of the figure lie all hues of a middle tint and of maximal chroma. Between base and poles lie the same hues in all their further variety of tint; all are still of maximal chroma, though the chromatic maximum decreases steadily, above and below. If we cut into the pyramid, from any point on the outside to a corresponding point upon the axis, we lay bare a series of sensations of the same hue and tint, but of varying chroma.

"The double pyramid, then [as shown in Fig. 3], embodies the two systems of visual sensations, sensations of light and sensations of color, and shows these systems both in their mutual independence and in their mutual relations. There are at least a hundred and fifty distinguishable hues

round the base. In counting up the whole number of visual sensations we must, however, take account also of differences in tint and in chroma. These are ultimate differences: a pink is no more analyzable by introspection into a red and a white than an orange-red is analyzable

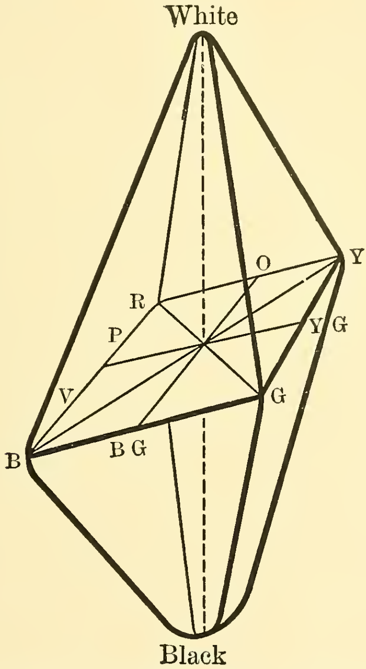

Fig. 3. The system of color sensations: color pyramid. (After Titchener.)

into a red and an orange. All in all, the full tale of visual elements can not fall far short of thirty-five thousand." (Text-book of Psychology, pp. 63, 64.)

AUDITORY SENSATIONS

There are two systems of auditory sensations.—Like our sensations of sight, our sensations of sound fall into

two classes: tones and noises. Of tones the normal adult person experiences between 10,000 and 12,000; of simple noises, at least several hundred. Every auditory sensation possesses qualitative and intensive attributes. Especially noteworthy among the latter is the property of extensity or voluminousness. The low tone is large, the high tone small whether they be weak or loud. Thus the croak of a bull-frog seems to us voluminous and that of a tree-frog piercing, shrill, and less extensive than the former. It is quite possible for us to experience tones apart from noises, but it is doubtful whether a noise ever lacks a tonal accompaniment. Few indeed of what we are in the way of designating as sounds are either simple and unanalyzable tones or noises. Almost all of them are complexes of these elemental experiences.

Sensations of tone.—The lowest audible tone is produced by a vibration rate of the air varying from 12 to 30 complete vibrations per second: the highest audible tone is produced by a rate of from 25,000 to 40,000 complete vibrations per second. Between these two extremes—the lower and the upper limits of hearing—we experience a number of sensations whose most conspicuous difference is in pitch. Beginning with the lowest audible tone, it is possible to progress by steps of just perceivable difference to the highest audible tone. The number of sensations (distinguishable pitches) in this series differs for individuals and for the same person at different times. One's age and condition of health are important in this connection. In general the range of hearing, and therefore the number of tones which one experiences, tends to diminish rapidly with increase in age, and with failing health.

Like our achromatic sensations, our tonal sensations may be graphically represented by a plane. Upon a straight line all the pitches between the lowest and the highest may be indicated by dots, and upon lines at right angles to

this pitch axis may be shown the number of degrees of loudness or intensity in which each tone is heard. That this representation of our tonal system is not complete becomes obvious when we stop to consider that each tone and loudness may appear in two or more degrees of clearness, in a number of durations, and possibly also in a variety of extensities. This should remind us of the fact that no one aspect or property of a sensation may be studied profitably without consideration of the properties which are intimately associated with it, since as one property varies the others are quite likely to vary also within certain limits.

In affective value auditory sensations differ markedly.—Many low tones are decidedly unpleasant because of their great extensity or volume, and many high tones are similarly unpleasant because of their slight extensity and the consequent cutting, penetrating, piercing effect. All in all, sensations midway between the extremes of the tonal series appear to be the most pleasant.

Sensations of noise.—Noises have many points of resemblance to colors, as tones have to achromatic sensations. In the first place, they can not be arranged, in the light of our present knowledge, in a continuous series. As each principal color seems to constitute in its various hues a separate mode or system of sensations, so every noise seems to present itself in a variety of forms, which together constitute a mode or system of auditory sensations. Snaps, pops, hisses, thuds, booms, roars, clicks, cracks, scrapes are names for noises. It is difficult to classify them by resemblance, yet doubtless we should agree that a snap is more like a crack than it is like a hiss, or that a boom is more like a roar than it is like a pop. It has been said that there are two classes of noises: sudden or explosive, and prolonged or continuative. This would appear to be verified by introspection, but there is no sharp line of demarcation, for the sudden noises, such as snaps, pops, cracks, gradually

give place to noises of longer and longer duration as we examine our experiences of noise. This classification rests upon the attribute of duration, and since sensations vary with respect to this property from the brevity of the flash-like toothache to the duration of the persistent pain, they can not be profitably separated into groups whose only difference is in duration.

Noises are peculiar in their affective values.—Some are extremely unpleasant; others are slightly pleasant; but few indeed are, for most individuals, very pleasant. We, of course, like certain noises and dislike others because of associations. It is necessary therefore, in observing the affective tone of a sensation of noise, to distinguish it clearly from acquired feelings for the noise. Certain noises, as for instance scraping, squeaking, grating sounds, are peculiarly and almost uncannily unpleasant. There seems to be something about them which irritates us, and we react to them somewhat as we do to spiders, snakes, and mice, with unthinking repugnance.

It is an interesting task to attempt to make out a list of names for noises, to arrange the several sensations in order of resemblance, and then to try to discover their relative pleasantness or unpleasantness. It is quite possible that persistent attention to these interesting auditory experiences may eventually enable us to classify them as satisfactorily as we now can arrange our visual sensations.

A program for the introspecting of auditory sensations.—We make surprisingly little progress in the study of any sort of consciousness if we work without a plan. We must have questions in mind, points of interest, more or less definite goals. It is for this reason that the following suggestions toward the observation of tones and noises are given.

First of all we should note the properties of tones and noises and learn to distinguish them readily. To make a

list of the psychological characteristics of each kind of auditory sensation will help greatly in this task. Next, tones should be compared carefully with respect to their qualitative aspects or attributes. It is fair to ask whether there are other qualities than pitch. Possibly we may discover that, like colors, tones or noises, or both, possess several qualities. The same question may be asked concerning intensive attributes. The intensity of a sensation is no more strictly a quantitative attribute than is its extensity or volume, supposing that it possesses that attribute, and there may be still other intensive properties which the patient and persistent observer can discover.

Noises should be observed with respect to their relations to tones. If, as some observers suspect, every noise, commonly so-called, consists of a tone and a simple noise, just as every color sensation really consists of a light and simple chromatic quality, we should not think of our ordinary experiences of noise as simple elements of consciousness.

Finally, there are endless possibilities of observation in connection with the affective tone of auditory sensations. The question of whether every auditory sensation is intrinsically pleasant or unpleasant each observer among us must answer for himself.

One need not listen to an orchestra in order to obtain opportunities for the introspecting of sounds. Indeed, it is as a rule far better to choose simple instead of complex experiences. A human voice offers us abundant materials for observation and our experience of its psychological peculiarities, as we listen to it, is well worth careful study.

CLASS EXERCISE

Self-observation. The introspection of achromatic visual after-images. Materials: sheet of white cardboard 22 x 28 inches, or thereabouts; sheet of black cardboard of same size; squares 2 x 2 inches of white and of black paper.

The white square should be fastened to the black cardboard about six inches from one of the 22-inch edges. The black square should similarly be fastened to the white cardboard. About six inches from the opposite edge of each cardboard a pin-hole should be made.

Having instructed the class (1) to look steadily and directly at the square of paper, (2) likewise to look steadily and without movements of the eyes at the pin-hole in the lower half of the cardboard when directed to do so, and (3) to close the eyes between experiments in order to rest them, the instructor should furnish opportunity for the observation of after-images of light.

With the class attending, note-books ready for records, the instructor holds up the black cardboard and the members of the class look fixedly for fifteen seconds at the white square. The instructor then says, "Look at the pin-hole," and each individual immediately fixes the gaze upon that point on the cardboard and carefully observes the visual after-sensation.

This should be repeated at intervals of two to five minutes, during which the student writes an accurate account of his introspection, with fixation intervals of 5, 10, 15, and 20 seconds, and each individual should note the interval which gives the clearest, most persistent, and frequently returning after-image.

Next, the same experiments should be performed with the white cardboard and the black square. And, if time permits, like observations may be made with a gray square on the white and the black cardboards.

Of primary importance in this exercise is the description of introspections. Of secondary importance is the identification of "positive" and "negative" after-images and the noting of the characteristics of each. Such questions as the following may suggest points for discussion after the exercise. How long does the after-image last? Does it appear and disappear repeatedly? If so, how often and how rapidly? What fixation-time is most favorable?

The results may be carefully studied and a general report made by one member of the class. The following references should be used in connection with the preparation of a report:

Seashore, C. E.: Elementary experiments in psychology, chapter 1, "Visual after-images."

Myers, C. S.: Text-book of experimental psychology, pp. 89-91.
Titchener, E. B.: Experimental psychology, volume 1, part 2, pp. 37-50.

SUPPLEMENTARY READING

Titchener, E. B.: Text-book of psychology, §§ 14-28.
Calkins, M. W.: A first book in psychology, chapter 3.
Külpe, O.: Outlines of psychology, §§ 14-21.

CHAPTER XII

PECULIARITIES OF OTHER MODES OF SENSATION

"For the comparison of different kinds of pain—itch, smart, burn, ache, etc.—the application of a mustard plaster to a small area on the arm, a sharp rap on the palm of the hand with a ruler, and heat and cold stimulation were employed. Typical introspections for the first refer to itching as made up of intermittent pain sensations, fusing now into a sharp sting referred to a single point on the skin, now spreading and irregular as if hundreds of little bubbles were breaking through to the surface; followed by a suffused warmth coming in waves along with pain of increasing intensity until a fairly unanalyzable mass of heat and pain results. For the second: 'smart made up of prickly points; gets more steady, a general ache or throb; ache is below surface, large, of one piece, rounder edges than smart.' Similar observations on heat and cold pain, and the use of ginger, pepper, vinegar, lemon, etc., on the tongue, bring out the fact that the observers feel no need of different qualitative terms in distinguishing any of these sensation experiences, even when for the sake of more exact comparison they followed closely in succession."—Murray, Elsie: Organic sensations. *American Journal of Psychology,* vol. 20, pp. 440, 441. 1909.

Certain modes of sensation consist of discrete sense qualities.—We have noted that the visual and the auditory sense modes consist of sensations which are related to one another in such wise that they may be arranged in a continuous series. There are the achromatic series or system of sense qualities, the chromatic series, the tonal series. In each of these systems of qualities, a given sensation may be defined, in fact must be defined, with reference to its relations to other members of the series. This method of ordering sense qualities possesses many advantages for the scientist, and he has therefore searched diligently for like relations among the sense qualities of other modes, but thus far the search has yielded little.

The modes of sense to be considered in this chapter are not systems.—In the cases of taste, smell, pressure, warmth, cold, pain, movement, and organic sensations the various qualities are discrete. That is, they possess no definite relations to one another which would justify the observer in arranging them serially. Each particular quality is a unique experience and apparently unlike all the others. Particularly in the mode of smell it would seem that a system should be discoverable. There are hundreds of distinct qualities, yet the psychologist has failed to discover a satisfactory basis of classification.

Psychological peculiarities of gustatory sensations.—The sense of taste is peculiar in that we confuse its special qualities to a surprising extent with oral sensations of touch and temperature, as well as with smell sensations. To any one who has not tried the experiment, tasting a variety of foods with the nose held tightly closed so that none of the substance can pass into the region of the sense organs of olfaction, is an illuminating experiment. It serves to convince one that a great many sensations which are ordinarily thought of as tastes belong instead to the modes of smell, touch, or temperature. So striking, indeed, is this experiment, that we are led to doubt our ability to distinguish by taste a number of things which we ordinarily consider markedly different in this respect. This is a commonplace example of the kind of information self-observation provides. After all it would seem decidedly worth while to know whether one is tasting or smelling a substance!

There are only four classes of tastes.—During the last twenty years a considerable amount of excellent work has been done on the sense of taste. Of prime interest has been the question, How many distinguishable qualities of sensation are there in this mode of sense? Early in the scientific history of the subject, there were thought to be

many, later several, finally six, and at present the majority of observers agree in distinguishing only four. Whether these are strictly qualities—as are a quality of green, of black, of tone, or of noise—or, instead, classes of qualities as are the blacks, whites, grays, reds, blues, noises, etc., is a question which the writer would answer by stating that they are classes. The four fundamental varieties of gustatory sensation are sweet, sour, bitter, and salt. And although we certainly do distinguish many sweet sensations, and many sensations in each of the other classes, it is still uncertain whether these differences are due to the quality of the sensations rather than to accompanying sensations of touch and temperature, and to affections. Certainly there are many widely differing chemical substances which can not be told apart by the quality of the taste which they evoke. Witness the sweet taste of cane sugar and of lead acetate. It would seem then that we are certain of the existence of only four taste qualities. This small number is in striking contrast with the large number of qualities of visual and auditory sensations.

Olfactory sensations.—Like taste, smell is one of the chemical senses, but in its case we are even less able to bring the various qualities into a series than in the case of taste. We can not even classify odors satisfactorily, for the reason that no principle of arrangement has been discovered. What we know from casual observation, not less than from careful introspection, is that we experience a great and interesting variety of olfactory qualities. How many hundreds or thousands of distinguishable sensations exist in this mode no psychologist is able to say. For in spite of persistent and intensive research we are still discovering new qualities, as we come to test new substances. In fact, it would seem probable that the creation of new odorous substances might indefinitely continue to add to our list of odors.

On the basis of qualitative resemblance, Professor Titchener, in his "Text-book of Psychology," gives the following classes of smells. This grouping follows mainly the naturalist Linnæus:

1. *Ethereal or Fruit Odors.*—All fruit and wine odors; the scents of the various ethers; the smell of beeswax.
2. *Aromatic or Spice Odors.*—All spicy smells: camphor, turpentine, cloves, ginger, pepper, bay leaves, cinnamon, caraway, anise, peppermint, lavender, bitter almonds, rosemary, sassafras; thyme, geraniums, bergamot; rosewood, cedarwood, etc.
3. *Fragrant or Flower Odors.*—All flower scents; vanilla, tonka bean, tea, hay; gum benzoin, etc.
4. *Ambrosaic or Musky Odors.*—Musk, ambergris, sandalwood, patchouli.
5. *Alliaceous or Leek Odors.*—Onion, garlic, asafœtida; india-rubber, dried fish, chlorine, iodine.
6. *Empyreumatic or Burned Odors.*—Roasted coffee, toast, tobacco smoke, tar, burned horn, carbolic acid, naphthalene, benzin, creosote.
7. *Hircine or Rank Odors.*—Stale cheese, sweat, valerian, root and stem of barberry and black currant, lactic acid, caproic acid.
8. *Virulent and Foul Odors.*—Opium, laudanum, French marigold, fresh coriander seeds, bed bugs, squash bugs.
9. *Nauseous Odors.*—Carrion flowers, stinkhorns, water from wilted flower stems, decaying animal matter, fæces.

Sensory adaptation.—An important fact of sense psychology, not peculiar to the psychology of smell, but especially well exhibited therein, is adaptation. Translated into non-technical language, this means that we can not for any considerable period of time continue to experience a given sensation quality in its original intensity, even if at all. A color sensation may enter and remain as a portion of consciousness for seconds or even for minutes, with fluctuations in clearness due to changes in the content of consciousness, but it does not necessarily undergo any radical

alteration in quality or intensity. It neither disappears nor changes into a new quality. This is not true of smell. At this instant I experience vividly an agreeably penetrating odor coming from the photometer room in which an amyl-acetate lamp is burning. I note the quality and intensity introspectively and set my mind to discover how long I can remain conscious of the impression as essentially the same. In a few seconds I know that the sensation is becoming weaker, and after a longer interval, I note also that the quality is difficult to distinguish from other odors. As the physiologist puts it, I have become adapted to the odor and no longer experience it as I did at first.

Precisely the same is true of temperature sensations. Whereas when one first enters a hot room, the temperature sensations are intense and vivid, one soon becomes adapted, or, as we say, accustomed to the heat and no longer experiences the sensations. Or, if the two hands be held for a few minutes, the one in cold water and the other in warm water, and they then be plunged into water of an intermediate temperature, it will not seem the same for both hands.

The importance of escaping sensations.—That it is well for us to be able to get rid of sense qualities is obvious. If we had to continue to smell a disagreeable odor which upon our entrance to a room was intense, we should have much greater cause to be dissatisfied with our sense of smell than we now have. Adaptation protects us from this disagreeable fate. It is a provision against too much sensation of a given variety!

A peculiarity of sense terminologies.—It is significant that for the sense qualities of some modes we have special names, while for those of others we wholly lack such terms. For vision we have the names red, orange, crimson, green, blue, purple, violet, pink, brown, yellow, ochre, etc., each designating a particular group of color qualities, or in some

cases a particular quality. The case of sound is utterly different, for it is only by reference to some system of musical notation or to a physical method of describing the stimulus that we can name the particular tonal quality which is being experienced. We have no particular names for auditory experiences of the tonal series apart from our musical notations, although we have a variety of names applying directly to noises and complexes of noises, or combinations of tones and noises—crack, boom, roar, thud, creak, crash, snap, scrape. For taste qualities we have a few particular names, few indeed in comparison with the number of visual words, but each of them definitely applies to a distinct quality, and it is even possible that for every one of the fundamental gustatory qualities we have a term: salt, sweet, bitter, sour indicate elemental qualities; alkaline, metallic, astringent instead refer to experiences which most observers consider combinations of sensations, the chief factor in which is one of the four gustatory qualities. The alkaline taste, for example, is analyzable into salt (or sour) plus certain temperature and touch sensations. Our taste terminology is scanty, yet apparently it is sufficient for all ordinary needs.

Unlike taste words, the words for smell sensations refer to the source of the sensation. In almost every instance we designate the quality by naming the sensation after the object. It is an odor of roses, of tar, of ether. Only the psychologist or the physiologist is likely to use such terms as are used in the classification of odors given above, and even in that it is apparent that there is a double system of terms—the first naming the odor itself, the second designating the source of the same. Doubtless the psychological significance of the way in which language develops [1] is of great importance.

[1] See Ebbinghaus, H.: Psychology, § 16, for good brief discussion of this topic.

The cutaneous or skin sensations.—From the skin we obtain, or rather to it we refer, several important modes of sensation. Chief among them are pressure, pain, warmth, and cold. Each term designates a particular quality of sensation. There are many decidedly different experiences of touch, contact, pressure, tickle, and tingle in which the fundamental quality of sensation is pressure, but with this are associated other sense qualities so that the complex has a character of its own.

The skin gives us many modes of sensation but few qualities.—Whereas the eye gives us thousands of different qualities of sensation and only a few modes, the skin gives us several modes and few qualities. Some observers think they experience different qualities of contact, pressure, or touch, but it is extremely difficult to be certain that these are not intensity differences in the one quality of pressure sensation. To the beginner it inevitably seems that each mechanical stimulation of the skin yields a new quality of sensation, and this may be the case. At any rate, the sensations of light touch are quite different from those of strong pressure, and both are different from tickle. Only the experienced introspector is able to discover the common quality of these experiences.

The temperature sensations are peculiar in that they range from zero to an extreme in two directions.—One of these extremes is known as cold; the other, as hot. From the zero point of temperature sensation to the maximal sensation of heat is an intensity distance, and the same holds of the range from zero to the maximal cold sensation. Wherever the temperature sensation appears it has one of two qualities: either warmth or cold. Unlike the light sensation series, the temperature series is an intensive series, for each sensation differs from its neighbor only with respect to intensity. This fact is relatively easy to verify in introspection. The extremes of heat and

cold are much alike in quality and may readily be confused.

Tickle, tingle, pins and needles, and similar sensations.—Although these several sense qualities, or complexes thereof, seem very different at first, they turn out upon closer study to consist of pressure qualities plus certain other sensations. Tickle is weak pressure; pins and needles sudden strong pressure often repeated; the tingle which comes from a sharp blow seems to be pressure quality mixed with other modes of sensation. All of these experiences are likely to be mixed. They must be examined carefully if the fundamental quality is to be discovered.

Pain sensations.—The quality of pain is similar and single, wherever it occurs. We distinguish many kinds of pain according to the intensity, duration, extent, and other properties of the sensation, but of quality there appears to be only one. This is sometimes referred to the skin, sometimes to deeper portions of the body, as, for example, when the lungs, stomach, heart, or any other internal organ is the center of disturbances. It is clear that the pain quality is something very different from most other sensations. It has the property of commanding attention and in its higher intensities it crowds everything else out of consciousness.

Because pain uniformly accompanies maximal sensations of many modes it has been supposed by many observers to be a property of the sensations rather than a separate quality. The fact seems to be that a maximal stimulus of almost any sort sets the pain organs into activity as well as the special organs for the reception of that particular mode of stimulus. Thus it comes about that pain and other sense qualities may appear in consciousness almost simultaneously and are difficult to distinguish. Many of the sensations which we habitually call pain sensations are in reality mere disagreeable intensities of other qualities of

sensation. It requires some introspective experience to distinguish the pain quality so that it shall not be mistaken for other qualities. Even an intense light is said to become painful. What does this mean? Merely that the observer is experiencing both light sensation and pain sensation. The latter because the strong photic stimulus has set up bodily changes which bring the sense organs of pain into operation.

Sensations of movement.—All of our sensations from muscles, joints, tendons, and the motor mechanism generally may be grouped as movement sensations. That there are several qualities of movement sensation can readily be determined if attention be paid to the sensations connected with an arm bent at the elbow strongly and slowly. The muscle sense quality is likely to be confused with joint and tendon sensations unless special precautions be taken to simplify the experience. The joint sensations may be observed to advantage when an arm is moved passively.

For further facts concerning sensations of movement, as well as of the other modes, the reader is referred to the admirable presentation of this general subject in Professor Titchener's "Text-book of Psychology."

After-sensations or after-images.—After-images corresponding to several of the modes of sense may be observed. Most obvious are those of sight, hearing, touch, temperature, and pain. But of all of these varieties of after-images the visual are the most interesting and the most readily studied. We may therefore advantageously use them to illustrate the points to be made in a general description of the phenomenon of after-sensations.

"The positive [visual] after-image has the same relations of brightness as the stimulus, as in a photographic positive. The negative after-image has the relations of light and shade reversed, as in the photographic negative. The after-image may be of the same color as the stimulus,

or it may be other-colored. There are positive same-colored and positive other-colored, negative same-colored and negative other-colored after-images. Generally, however, positive after-images are same-colored and negative other-colored are complementary.

"The positive after-image appears first and is usually very short in duration and difficult to detect. To make it conspicuous, one must employ a strong stimulus. . . . After some training one may see the positive after-image before the negative in the exposure of ordinary objects of moderate intensity." (Seashore, C. E.: Elementary Experiments in Psychology, p. 7.)

The after-images of the different modes of sense differ greatly in speed of development, in duration, and in clearness. All varieties of the phenomena possess quality, intensity, duration, clearness, and, possibly, extensity. Some are fairly easy to observe—pressure, pain, temperature, visual, auditory—others are difficult to note and more so to study introspectively.

CLASS EXERCISE

Self-observation. The introspection of the after-images of color sensations. Materials: Sheets of white and of black cardboard as in previous experiment; pieces, 1 x 1 inch, of red, yellow, green, and blue papers. (The Milton Bradley colored papers will serve.)

The procedure in this exercise should be determined by the results of the method employed in the previous observations of after-images. The instructor will almost certainly be able to improve upon the plan.

Questions: What relation does the color of the after-sensation bear to the primary sensation? Does it fluctuate, now appearing, now disappearing? Does it undergo changes in clearness? Does it change in color? Does it move with the eye?

After the exercise, the reports of introspection may be delivered to some member of the class for thorough study, in the

light of the literature on after-images mentioned at the close of the preceding exercise, and for report to the class.

SUPPLEMENTARY READING

Titchener, E. B.: Text-book of psychology, §§ 29-59.
Judd, C. H.: Psychology, chapter 5.
Angell, J. R.: Psychology, chapter 5.
Schäfer, E. A.: Text-book of physiology, "Cutaneous sensations," "The muscular sense."

CHAPTER XIII

AFFECTIONS AS ELEMENTS OF CONSCIOUSNESS

"The feeling-tone with sensations from sandpaper is grating, irritating, stirring, stimulating. The feeling is one of contraction, of withdrawal, of uneasiness. One is full of 'collapsing chills,' of minute little pains, and there is a decided call for an opposite kind of behavior. The sense of weakness, of waste of power and energy, of being penetrated, of strained expectation, of unwelcome tension, and of slight 'wasteful excitement' results. To some subjects . . . at times the whole feeling of stimulation as such predominated, and the total effect produced was agreeable, as it 'satisfied a felt need of waking up.'"—Johnston, C. H.: The combination of feelings. Harvard Psychological Studies, vol. 2, p. 169. 1906.

A definition of affection.—We sense and we feel. The former variety of experience yields us our thousands of qualities of sensation, and the latter yields us a multitude of simple facts which the psychologist calls affections. One of the most prominent differences between sensations and affections is the reference of the former to particular bodily organs—the sense organs—and of the latter to the body as a whole. A sensation has as one of its characteristics a sort of local mark; an affection lacks this property. A pain, a touch, a taste exists in consciousness as awareness of the condition of a certain part of the body, whereas a feeling of relaxation, of agreeableness, or of restlessness exists as awareness of the condition of the whole body. An additional difference which helps us to identify the two types of conscious elements is that of clearness. Sensations vary in degree of clearness according to their position in the stream of consciousness, or, as is often said, according to the amount of attention they receive. The more we attend to them the clearer they become. Just the opposite

is true of affections, for the instant we try to introspect them they tend to become unclear and even to disappear from consciousness. This renders the study of affections very difficult.

As our working definition of affection we use this formula. An affection is a simple or elementary fact of consciousness which is not referred to any particular bodily organ (as are sensations) and which tends to diminish in clearness as it is examined (instead of to increase, as do sensations). This definition has the merit of enabling us to hold in mind two of the cardinal differences between the two great classes of psychical elements.

What would life be like if we sensed without feeling?—It is quite conceivable that a living being might either sense without feeling or feel without sensing. If the former were the case the mental life of the creature would consist of awareness of things and events both within and without the body, of ideas, of thoughts, and of all the other simple and complex experiences which are called cognitive. The awareness would be purely and coldly intellectual. It would lack feeling. And, on the other hand, if there were feeling without sensing, the stream of consciousness would be made up wholly of feelings of pleasantness and unpleasantness, of excitements and depressions, of tensions and relaxations, of emotions, and of sentiments; in a word, of all of the simple and complex experiences which are popularly grouped under the word feeling. How different these two imaginary types of mind! Imaginary we call them, but is this really the case? Are we not each of us acquainted with persons who are so predominantly intellectual or cognitive in their mental make-up that they seem to lack the ability to feel; and with other individuals whose ability to feel so overshadows their life of thought that they seem unintellectual.

Ways of classifying the affections.—We have already seen that sensations may be classified in any one of at least

three ways. Namely, according to their psychological properties, according to the sense organs to which they are referred, or according to the stimuli which set these sense organs into action. Is it possible also to classify affections in one or all of these ways? Let us, in turn, consider the three possibilities.

The stimuli or physical conditions of affections, as a basis of classification.—The definite conditions of sensations are physical stimuli, and adequate knowledge thereof should provide a useful basis for the arrangement of sensations, and more especially of sensory-reactions, but unfortunately our knowledge is not adequate and consequently at present sensations are not satisfactorily classified according to their appropriate stimuli. Of affections it may be said that their physical conditions are even less adequately understood. About all that we really know is that predominantly destructive, or as the physiologists name them katabolic, changes in the body are accompanied by feelings which we group as unpleasant, depressing, and wearing, whereas those changes which are predominantly constructive, or anabolic, are accompanied by feelings of pleasantness, elation, and vigor. This roughly divides our affections into two large groups (1) those which accompany the building-up processes in our bodies, and (2) those which accompany the breaking-down processes. A like division of our sensations may be made on the basis of changes which occur on the surface of the body and give rise to sensations of the special senses, and those which occur within the body and are accompanied by organic sensations. We know well that this grouping does not constitute a very useful classification and we may be equally certain that our affections should be classified otherwise than by being grouped with reference to the katabolic and the anabolic bodily changes. Doubtless there are many kinds of destructive changes within us, each with its appropriate class of affections, and

similarly many kinds of constructive changes to each of which a class of affections corresponds.

When we are in good health and full of energy our feelings are predominantly agreeable. When we are diseased, fatigued, feeble, they are predominantly disagreeable. It is this simple observation which gives the starting point of our classification of affections according to their "stimuli" or physical conditions. It certainly seems worth while to attempt, by more thorough study of the nature of the physiological changes in the organism, to obtain a basis for the subdivision of the "katabolic" affections and the "anabolic" affections.

Affective organs, as a basis of classification.—Apparently there are no bodily organs whose sole concern is with affections. For the reception of many of the modes of energy in the world of physics we have special organs, the sense organs, but to these there is nothing which corresponds on the side of affective experience. To any portion of the body, or to the whole body, a given feeling may be referred at different times. There is, it would seem, no basis whatever for a grouping of the affective elements of consciousness in this direction. Affections appear to have reference rather to a particular state or condition of the organism than to a particular organ or part of the body. Hence it is that we look more hopefully to "stimuli," as a basis of classification, than to "organs."

Psychological properties, as a basis of classification.—As in the case of sensation, the only truly psychological way of arranging affections is with respect to their properties—their psychical resemblances and differences. It is upon this basis that the groups commonly recognized are formed. We all distinguish certain feelings as agreeable and certain others as disagreeable. And we may also distinguish from these large groups feelings of restlessness and

quiescence. There appear, then, to be modes of feeling just as there are modes of sensation, but as to the number and relations of these modes there is much uncertainty. This is in part due to the difficulty in introspecting affection and in part to the recency of intensive study of the subject. On the whole it looks as though our list of modes of affection were much further from completeness than that of the sense modes. We suspect that there are many classes of feelings, but when we seek to verify our suspicion by introspection we discover only a few. Yet here again there is as one might expect wide difference in opinion. The majority of psychologists maintain that there are only two modes of affection, feelings of pleasantness and feelings of unpleasantness. Others hold that four classes or modes may be distinguished, feelings of restlessness and feelings of quiescence in addition to the two which are universally accepted. And still others, few in number, claim that they can distinguish yet another pair of modes, feelings of excitement, and feelings of depression.

Lists of feelings given by different psychologists.—

WUNDT	ROYCE	TITCHENER
Agreeableness	Pleasantness	Pleasantness
Disagreeableness	Unpleasantness	Unpleasantness
Excitement	Restlessness	
Quiescence	Quiescence	
Tension		
Relaxation		

Are there four distinct modes of affection?—In the list of modes of affection offered by Professor Royce, there are four classes of feelings. They are pleasantness and unpleasantness, restlessness and quiescence. Because of their

obvious opposition they are grouped in pairs. It is quite impossible to have pleasant and unpleasant feelings at the same time, and it is just as impossible to have feelings of restlessness with feelings of quiescence. But it is possible to experience pleasantness with either restlessness or quiescence, and so also of unpleasantness.

Pleasant and unpleasant feelings are receptive affections.—All sensations are likely to be accompanied by feelings. These are called sense-feelings. They are predominantly agreeable or disagreeable according as the sensation increases or diminishes the vital processes. This pair of affective modes is characteristic of the passive as contrasted with the active organism. If we were incapable of movement of any sort, if we could not react to stimuli within or without our bodies, we probably should experience feelings of pleasantness and of unpleasantness because of the ways in which the body would be influenced by sense-stimuli, but we probably should not experience feelings of restlessness and of quiescence.

Restless and quiescent feelings are reactive affections.—This pair of affective modes is intimately related to the attitude which the organism takes toward things. It is connected with what the animal does rather than with what it receives in the shape of sensations. When one or another condition impels us to action we feel restless in some one of many different ways. When the condition does not demand movement, we feel quiescent.

Are there many qualities for every mode of affection?—Whereas there are not more than a score of modes of sensation known at present, there are many thousands of distinguishable qualities of sensation and there are still more sensation-elements of consciousness, since each quality may appear in a greater or less variety of intensities, clearnesses, durations, extensities, and relations to other elements of consciousness. Precisely the same may prove to be true of

affections. Although the modes which are generally recognized are few—at most not more than six—the number of distinguishable qualities may be great, and that of affective-elements far greater.

The properties of affections.—Throughout the foregoing discussion we have assumed that affections possess quality. That this assumption is correct it requires only brief self-observation to convince us. Each feeling differs from another in kind or quality. The unpleasant affection accompanying a headache is not to be confounded with the pleasantness connected with a rich warm color experience, or even with the unpleasantness of a bruised finger, for the three differ in that fundamental property we call quality. In fact, it is this difference which furnishes the basis for the classifications which have been described. Psychologists generally recognize that every affection, as well as every sensation, possesses quality, but they are not agreed as to the number of varieties of quality which deserve to be ranked as modes of affection.

Affections possess the property of intensity, as well as quality.—The affection accompanying headache, toothache, color, burn, taste may range in strength or intensity from weak to strong. Affections have a threshold, just as do sensations, and there is an upper limit beyond which they may not transcend. This seems to be true for every one of the qualities of affection which are included in our several modes. The disagreeableness of a headache may be mild and unobtrusive, just a vague discomfort in the background of consciousness, or it may be strong and intrusive, an unwelcome visitor in the forefront of the stream of consciousness. And between the extremes—the minimal and the maximal intensities—an affection may occur in any one of a multitude of degrees of strength. Experimental psychology has not with precision determined the number of distinguishable intensities of our affective qualities. The

task is a difficult one, but by no means impossible of performance, and it is to be hoped that we shall sometime know how many affective elements really appear in consciousness.

Affection possesses also the property of duration.—No element of consciousness can be thought of as lacking duration. In general, it is true that feelings last much longer than sensations. They fluctuate in intensity from moment to moment, but they often remain in consciousness for minutes. There are few affective experiences which flash through consciousness with anything approaching the rapidity of the sensation of an electric shock. They last for a measurable length of time. This facilitates the study of them, and were it not that they tend to disappear as soon as one begins to introspect, they would be easier to observe than are sensations.

Is clearness a property of affections?—In the case of sensations we have distinguished clearness from intensity because a weak, a medium, and a strong sensation may be equally clear or unclear. In other words, because the definiteness with which a sense element stands out in introspection seems to be fairly independent of its intensity. Is this true of the affections?

Just a moment ago, I experienced a feeling of depression because of the large number of kinds of sense impressions which interfered with my attempt to introspect a feeling of agreeableness. The feeling had a life span which could be observed and definitely described. Like a sensation it slowly came into being, lasted a moment at its maximum clearness, and waned. It acted, so far as I could observe, something as does a sensation. The only difference was that attempts at introspection caused the affection to diminish in clearness instead of to increase. It would seem, then, that a feeling has clearness as well as quality, intensity, and duration, and that the duration and clearness

are markedly influenced by introspection. But here we evidently have a problem for careful consideration, for Professor Titchener comes to the conclusion that affections lack clearness. The first difference between sensation and affection, he says, is this: "that affection lacks the attribute of clearness. Pleasantness and unpleasantness may be intensive and lasting, but they are never clear. This means if we put it in the language of popular psycholgy, that it is impossible to attend to an affection. The more closely we attend to a sensation, the clearer does it become, and the longer and more accurately do we remember it. But we can not attend to an affection at all; if we attempt to do so, the pleasantness or unpleasantness at once eludes us and disappears, and we find ourselves contemplating some obtrusive sensation or image which we had no desire to observe." (Text-book of Psychology, p. 231.)

Is this really the case? Have affections clearness or have they merely the common properties of quality, intensity, and duration? To the writer it seems as certain that they possess clearness as that sensations possess this same property. Either an intense sensation or an intense affection may be clear or unclear. The affection, however, is never as clear as the sensation at its best, and it certainly tends to become unclear as it is observed.

In addition to the common properties of quality, intensity, clearness, and duration, affections have certain particular characteristics.—A feeling can not be adequately described with reference alone to its quality, intensity, clearness, and duration. Its individual properties must also be taken into account. The sense-feeling which is almost inextricably associated with the taste of bitter aloes differs in a number of respects from the feeling of depression which follows stage fright. To name a few of these special or particular properties as examples will render clearer the meaning of this statement. The sense-

feeling in question is more definitely limited in its bodily reference; it interferes more acutely with attention to other features of consciousness; it tends to stir one up instead of to depress; it possesses, usually, a high degree of clearness; it has its own particular affinities with other elements of consciousness. In all of these respects the two feelings are markedly different.

This suffices to show that our business as psychologists is not merely to discover whether a given feeling possesses any two, three, or four common properties of affection, but instead to learn all we possibly can about both its essential and its accidental properties.

CLASS EXERCISE

Self-observation. The introspection of the affective values of colors. Materials: squares, 6 x 6 inches, of Milton Bradley red, orange, yellow, green, blue, and violet papers (the number of hues may profitably be increased to ten if the time available for the exercise permits the use of so many); a piece of gray cardboard about 24 x 24 inches with two windows near its center, each 4 x 4 inches and with a space of 2 inches between them. It is convenient to have the gray cardboard mounted on wooden blocks so that it will stand upright. Around the lower and vertical edges of the windows in this cardboard a pasteboard molding should be fixed, as a means of holding the squares of colored papers.

With the gray screen set up before the class, the instructor directs that each student compare, as they are shown, each pair of colors with respect to their agreeableness. It facilitates the recording of judgments and avoids errors if the instructor says each time, "Is the red (*e.g.*) more or less agreeable than the blue (*e.g.*)?" The symbol + may be used to indicate the judgment more agreeable; that of — to indicate less agreeable. Each color is shown in company with each of the others: for example, red with orange, red with yellow, etc., with the red always appearing in the window on the right of the observer. Later the same series of comparisons should be made, with the red appearing always in the window on the left.

The time of exposure of the colors should be kept fairly constant at 5 or 10 seconds.

Each student should prepare in a note-book two or more blank tables, like the accompanying form, in which to record judgments. In this blank the result of comparing red with orange, with red on the right, would be recorded in the upper line, first blank space at the left. If the judgment were red more agreeable than orange, a plus (+) would be written in the blank; if less agreeable, a minus (—).

When comparison has been made of each color in the right window with each other color in the left window, the table contains thirty records, five for each of the six colors. As it is desirable, if possible, to obtain ten, fifteen, or twenty judgments for each color, the series of comparisons should be repeated two, three, or four times, as time permits.

The following typical tables of results will render these directions clearer. In these sample tables the results given by one individual are recorded. The plus (+) signs indicate that the standard color, which for a given horizontal line in the table is always printed at the left, was judged to be more agreeable than the color with which it was compared. Thus, in Series 1, orange, yellow, green, and violet were each judged as less agreeable than red, whereas blue, as is indicated by the minus (—) sign, was judged to be more agreeable.

SERIES 1. Standard color on left

	Red	Orange	Yellow	Green	Blue	Violet	Totals
Red	\	+	+	+	—	+	4
Orange	—	\	—	—	—	—	0
Yellow	—	—	\	—	—	+	1
Green	—	+	+	\	—	+	3
Blue	+	+	+	+	\	+	5
Violet	—	+	+	—	—	\	2
Totals	4	1	1	3	5	1	30

Series 2. Standard color on right

	Red	Orange	Yellow	Green	Blue	Violet	Totals
Red		+	+	+	−	+	4
Orange	−		−	−	−	−	0
Yellow	−	+		−	−	+	2
Green	−	+	+		−	+	3
Blue	+	+	+	+		+	5
Violet	−	+	−	−	−		1
Totals	4	0	2	3	5	1	30

In the right margin of the table for each series is given the number of judgments in favor of each color. This number is obtained by adding the plus signs. In the last horizontal line of each table the number of judgments in favor of a given color is obtained by adding the minus signs. For Series 1 red, when used as the standard color, was judged more agreeable than the compared color four times; when used as the compared color it was judged more agreeable four times. The sum of these two results, eight judgments, indicates that red was preferred to the other colors by this particular individual eight times in ten.

Following this method of obtaining the number of judgments in favor of a given color, we obtain by adding the results of the two series the following figures:

Color	Red	Orange	Yellow	Green	Blue	Violet
Judgments in favor of	16	1	6	12	20	5

This yields as the order of preference for the six colors—blue, red, green, yellow, violet, orange.

After the experiment has been completed, the tables of judgments should be worked over by some one member of the class for report. The following questions may suggest ways of dealing with the results:

Are individuals consistent in their judgments? This can be

answered only if the comparisons have been made more than once.

What is the order of preference for the several colors?

Is it the same for both sexes? Can you offer any reasons for the preferences which your own judgments indicate?

SUPPLEMENTARY READING

TITCHENER, E. B.: Text-book of psychology, §§ 68-74.
ROYCE, JOSIAH: Outlines of psychology, chapter 7, "The feelings."
WUNDT, WM.: Outlines of psychology, § 7.
SEASHORE, C. E.: Elementary experiments in psychology, chapter 15.

CHAPTER XIV

PSYCHIC COMPLEXES: PERCEPTION

"To a child the taste of lemonade comes at first as a simple quality. He later learns both that many stimuli and many nerves are involved in the exhibition of this taste to his mind, and he also learns to perceive separately the sourness, the coolness, the sweet, the lemon aroma, etc., and the several degrees of strength of each and all of these things,—the experience falling into a large number of aspects, each of which is abstracted, classed, named, etc., and all of which appear to be the elementary sensations into which the original 'lemonade flavor' is decomposed."—JAMES, WM.: Principles of psychology, vol. 2, p. 2, footnote.

The elements of consciousness exist only in psychic complexes.—Elementary sensations and affections exist in isolation only during the early stages of mental life. Long before one reaches the period of self-consciousness and introspective ability they have disappeared, lost in a maze of complex relations and overshadowed by important concrete experiences. It is, then, only by the analysis of these experiences of later life that we approach a knowledge of the constituent elements of consciousness. Having in the previous chapters of this introduction examined the varieties and properties of the elementary mental phenomena, sensations, and affections, we are now prepared to study psychic complexes. Emerging from the sea of artificial products of analysis with which psychologists surround themselves, we shall plunge into the familiar and vitally interesting world of concrete experiences.

The kinds of psychic complexes.—It is convenient to separate our experiences into two classes: (1) Those which consist wholly or chiefly of sensations or images, and (2)

those which, instead, are composed principally of affective-elements. The first we shall call sense-complexes (perceptions, ideas), and the second, affective-complexes (feelings, emotions). In the present chapter we shall limit our attention to the sense-complexes.

Sensations, perceptions, and ideas.—For psychology a sensation is a particular kind of psychic element: for common-sense it is, more frequently, an experience which is made up of a number of such elements. Popularly we talk of sensations of sight, of sound, or of touch, or of taste when we really mean what the psychologist designates as perceptions. For a visual experience which consists of a group of sense-elements is really a visual perception, not a sensation; the sound which is made up of noises, overtones, and a fundamental tone is an auditory perception; the taste, as of lemonade, which consists of a number of gustatory qualities, certain olfactory and other qualities, confused almost beyond recognition, is a gustatory perception. From these examples of the technical application of the term perception, it is clear that the word is used to designate psychic complexes which are made up chiefly of sense-elements.

Psychology makes another distinction which is important in this connection. It contrasts experiences which come to us directly and immediately through the senses as perceptions and those which are remembered as ideas. I have a perception of the taste of banana when I have the substance in my mouth and experience sensations, but I have, instead, an idea of it when I experience images.

An idea differs from a perception in that it consists chiefly of images, whereas the perception consists chiefly of sensations. "Look across the room and you perceive the table; shut your eyes and you ideate the table." This distinction is important for we shall later have to consider the respects in which immediately perceived psychic complexes

(perceptions) differ from the same complexes when they are remembered (ideas).

Varieties of perception.—As is hinted in the foregoing paragraph, it is quite possible to classify our perceptions according to the mode of sensation which is prominent or predominant. We speak of visual, of auditory, of tactual, and of other kinds of perceptions, meaning thereby to indicate the fact that in these psychic complexes some particular mode of sensation is preëminently important. It is this principle of classification which has given origin to the notion of perceptual and ideational types. Persons whose perceptions or ideas are characterized chiefly by visual sensations or sense-images are said to belong to the visual type: they are visualizers. Those whose perceptions and ideas are made up chiefly of sensations or images of sound are said to belong to the auditory type. Still others, because of the predominance of tactual and organic sensations, are characterized as tactual-motor in type. But perhaps the most frequented of all the perceptual and ideational groups is that which is known as the mixed, for it includes all those persons whose experiences are not predominated by any one kind of sensations or images.

Sir Francis Galton's study of mental imagery, as reported in his "Inquiries into human faculty," should be read by every student of psychology, for it constitutes one of the most interesting, as well as illuminating, of the contributions to psychology. Few persons know enough about their perceptions and ideas to say with certainty whether they belong to the visual, the auditory, the tactual-motor, or the mixed, type. This is something to be ashamed of, as one should be ashamed of ignorance of his age, date of birth, or nationality. If psychology does no more for each of us than stir us to an introspective study of our perceptions and ideas so that definite information about them shall be obtained, it will have benefited us greatly.

The relation of perceptions to the properties of sensations.—Another basis for the classification of our perceptions is the importance of the several common properties of sensation in the complex. From this point of view we may distinguish qualitative perceptions, extensive perceptions, and intensive perceptions. Professor Wundt distinguishes just three classes: (1) the intensive, (2) the spatial, (3) the temporal. Professor Titchener enumerates the extensive, the temporal, and the qualitative. In their definitions of the temporal and the spatial they agree, but whereas Professor Titchener states that "intensive ideas" are non-existent, because of the fact that intensity is always bound up with quality, Professor Wundt uses the term intensive to designate what Professor Titchener calls the "qualitative idea."

The two methods of classification do not conflict.—The perceptions of any particular mode of sense, as for instance the tactual, may belong to any one of the types mentioned above. They may be qualitative, extensive (spatial), durational (temporal), or, provided we succeed in distinguishing this variety from the others, intensive. Each of the classes which we obtain on the basis of the predominance of sense-elements may, therefore, be split up into three or four parts. Thus we come to distinguish a dozen or more varieties of perceptions and ideas. Of these the qualitative are by far the most interesting to the beginner in introspection.

Examples of tactual perceptions.—Through the senses of the skin—roughly grouped as tactual—we obtain sense impressions which combine into perceptions of several sorts. There are qualitative perceptions, for we are conscious of the nature of an object: it is hard, rough, sticky. There are extensive perceptions, for we are also conscious of the object as of a certain size, form, and position. There are durational perceptions, for we are aware of the sequence

of impressions as the finger or hand is moved over irregularities in the object. And it is possible that from these we may at times distinguish an intensive perception, as we become aware of the vividness, distinctness, or clearness of the complex of sense-elements without attending to the quality, extent, or duration. Sometimes I seem to discover this aspect of perception, but for the most part it is obscured by the other properties of sensations.

Examples of visual perceptions.—Visual perceptions are so prevalent in our mental life that it seems almost needless to cite examples. Glancing up from my typewriter my eye falls upon a row of books in a case. The experience which I observe is predominantly visual. First, I note the qualitative aspect of the perception. I am aware of the visual qualities of red, pink, brown, green, blue, black, and gold. These are the prominent features of my consciousness as I glance at the shelf. Then there is the experience of size, form, distance, position, for my eyes sweep along the line of books. The perception has changed from a purely qualitative complex of sensations to one in which extent is prominent: it has become spatial. Almost at the same time, I notice the serial arrangement of the books: the experience of rhythm breaks in upon my consciousness. This is enhanced by the fact that at one end of the shelf there are several volumes of about the same size, while in the middle there are a few large volumes which disturb the regularity of my eye movements. Thus the temporal aspect of my perception appears. At this moment I am not aware of anything identifiable as an intensive aspect of the experience, but I have previously observed that the light reflected from the glass door in front of the books gives me an experience which is best described as intensive. At such times I am conscious not of the characteristics of the books, of the size, or form, or position, or regular arrangement

of the objects, but merely of the intensive character of my visual complex. The consciousness is one not merely of light too bright for comfort, but it vaguely includes the books. In other words, it is for the time an intensive perception.

Examples of taste perceptions.—In many respects our so-called perceptions and ideas of the tastes of edible substances are interesting. They are not at all what we think them, for ordinarily we confuse olfactory with gustatory sensations, and sometimes we even fail to distinguish tactual and temperature sensations from those of taste and smell. A grape fruit, or a luciously ripe peach, yields us an experience which is surprisingly complex. For it consists of sensations belonging to several modes. Tastes, odors, touches, temperatures are interwoven in the psychic complex. Place a bit of the substance in the mouth, with the nose held firmly between the fingers so that no odor sensations can be received, and you may be startled to discover that what had previously seemed to be a taste has disappeared and in place of it there stand out the sensations of texture and temperature. Apple and potato are much alike, except for differences in texture, when the nose is held and olfactory sensations are thus excluded.

Foremost among the aspects of perceptions of taste is the qualitative. The qualities of sapid substances especially interest us. The ripe peach exists in consciousness primarily as the perception or idea of sweet juiciness. Secondarily we may become aware that the object is small or that it will not last much longer. Thus the extensive (spatial) and durational (temporal) ideas supplant the purely qualitative. At times, when we are comparing the experiences yielded by two sapid substances of like quality, a purely intensive perceptual consciousness of taste may appear, but as a rule the intensity or clearness is subordinate to the quality, extent, and duration.

The pleasantness or unpleasantness of tastes, or sounds, or sights.—Few indeed are the perceptions and ideas which lack affective accompaniments. Pleasantness is even more prominent in my consciousness of "ripe peach" than is sweetness or mild acidity or velvety softness. It seems to be an essential part or property of the sensations which go to make up my awareness of peach. It is important indeed that we should note that few perceptions and ideas lack value or affective accompaniments.

Perceptions of things or objects.—The consciousness of a particular object usually includes a variety of elements. Now the visual is the more important, now the auditory, or the tactual. At one instant the experience is qualitative, and at the next it is spatial, temporal, or intensive. My consciousness of a picture in my office contains a very large number of sense- and affective-elements which are so related or interconnected that I feel the unity of the experience. I readily convince myself that the picture consists solely of qualities of sensation and that my experience adds to these certain affective elements. But the many simple psychological phenomena so combine that I am aware of the object as having certain properties, a certain size, form, position, value for me. Ordinarily, then, what is called consciousness of an object is composed of a number of groups of conscious elements closely related and together giving a feeling of oneness to the experience. For this reason, among others, it is misleading to classify perceptions as perceptions of things, of space, and of time. The first really includes all of the others.

The furnishings of our minds are mostly perceptual or ideational experiences of objects or events.—Really our consciousness of things, or of essential features thereof, makes up the greater part of our experience. Our waking moments are filled with a succession of perceptions and ideas. Sometimes the train moves rapidly and is most

intricately interwoven by associative processes; sometimes it lags and we are bored by our lack of ideas or of power to relate them. By the number and complexity of relation of his ideas we measure the intellectual strength of a person. Each idea represents an item of information. The variety of these items, with respect to a given object, is very great, and most observers are able to continue to add to their store of information about a thing throughout their natural lives. Let us ask, What are some of the aspects of objects or happenings which are important to us?

Elements which combine in our experiences of objects or things.—It would be a long list that would include all of the elements in one's perception of an object. Those which are mentioned below are merely examples of the items of information which we seek.

Almost every question that we ask about an object or happening demands as its answer a sense experience, a perception, or an idea. Of the skates which are before me I ask: Are they sharp? Are they large enough? Will they fit my shoes? Are they properly curved? Is the steel sufficiently hard? When, where, and how shall I use them? Once I had completed the list of questions which I should naturally ask about a pair of skates before buying them, I should, if the appropriate answers were forthcoming, be provided with the information that would enable me to give a good description of the objects. I should know a large number of their chief properties. Each of our ideas about a thing really stands for a property or group of properties of the thing, just as each of our sense-elements constitutes a portion of a simple aspect of perception. But whereas the properties of the elements of consciousness are simple and neither describable nor analyzable, the properties or attributes of things are frequently complex and analyzable into sense-elements. The property of color in the book before me as it appears in my consciousness is

analyzable into chromatic and achromatic qualities of sensation. What I call the size of the book consists of related sensations of vision, of touch, or of both. The same holds for the other properties which enter into the experience of the object. For my consciousness the book is the sum of these bits of information, each of which stands for a property of the object itself.

Sensations, or images, of many modes may unite in a perception, or idea.—Although, as has been said, there are perceptions in which sensations of only one mode are present, as a rule a considerable variety of sense modes and qualities are represented. When we characterize an experience as visual, we mean either that it is exclusively made up of visual sensations or that it includes no other elements of importance. Most frequently the latter meaning is intended. There are few perceptions of things which are built up from a single mode of sense. Our qualitative perceptions of sights, pressures, tastes, sounds usually include sensations of other modes. Our extensive or spatial perceptions, as a rule, contain sensations from two, three, or four modes: the visual, the tactual, and the kinæsthetic.

Ideas tend to run together, or fuse.—Just as sensations and affections tend to unite in psychic complexes, so perceptions and ideas, in turn, tend to become grouped. My consciousness of the typewritten page is a group of perceptions and ideas, plus rather interesting affective elements. This fact is commonly expressed by the statement that perceptions and ideas become associated. Most books on psychology devote much attention to the varieties and characteristics of the association process. The word fire brings to consciousness an idea of noise; that, in turn, drags in the idea of men; men leads to the idea of running; running of engine; engine of water; water of cold; cold of frozen hydrant; and so on throughout a long series of ideas which I experienced recently in connection with

a fire near my office. Each of the ideas in the series is described as associated with the others.

Both perception and association involve the interconnection of psychic complexes.—Evidently we have transgressed the limitations set by the heading of this chapter, for instead of discussing psychic compounds we are now dealing with the relations of these compounds. Even the consciousness of an object is a complex of complexes, for it includes a number of associated perceptions or ideas. The fusion of sensations into groups, the fusion of these groups into a compound perception, the fusion of perceptions into a thought, are all of them associative processes. When the welding together, or fusing, of the parts occurs almost instantaneously it is called simultaneous association. When it occurs more slowly, it is called successive association.

Impression and image.—Our discussion of perception has neglected an important aspect of the subject. We have considered only the immediately experienced facts of consciousness, the sensations which come to us from moment to moment, utterly neglecting the images which enter into the composition of very nearly all of our perceptions. It is now impossible for me to perceive Professor Ebbinghaus' "Grundzüge der Psychologie" without having old sensations (sense images), familiar affections, and old ideas appear as parts of the experience. To my present impression of the book there is added these memory contributions and my perceptual consciousness of the object is a complex of these two sorts of psychic material. The consideration of the re-presentational (remembered) materials of consciousness as contrasted with the presentational has been omitted wholly in this chapter in order that it may be given fuller attention in chapter XVI.

False or misleading perceptions.—There are two well known types of misleading perceptions: illusions and hal-

lucinations. If two lines are perceived as of equal length when they really are different or if what is perceived as a rectangle is in reality a square, the perceptions are illusory. There are a great many optical illusions. An hallucination is experienced when the perceptual consciousness of an object appears although the object is not present. The person who sees a ghost in a black void is experiencing a false perception of the hallucinatory type.

In almost any text-book of psychology may be found descriptions of a number of illusory perceptions and of typical hallucinations.

CLASS EXERCISE

Psychological facts and laws as exhibited by advertisements. This exercise should be done out of class. Materials: Ten full-page advertisements selected from some magazine. The instructor should choose advertisements which in his opinion range from excellent to very poor. He should then provide himself with enough sets of these advertisements to supply each student with a set. Each advertisement should be plainly numbered at the top of the page. The writer uses a set of ten advertisements which he selected from a number of the *Century Magazine*. He obtained fifty copies of the magazine at a reasonable rate, tore them up, trimmed the pages which were to be used, and arranged them in sets. The cost of the sets was approximately twelve cents each. By using a cheaper magazine the sets might be obtained for a smaller expenditure.

A set of advertisements should be handed to each student with the direction to arrange the ten in order of excellence, from best to worst, after a general examination of the set. It should be emphasized that the arrangement is to be made rather on the basis of first impression than after detailed examination and careful study of each advertisement. After an order has been decided upon, the student should make a record thereof by using the numbers of the advertisements as, for example, thus:

Place:	First,	Second,	Third,	Fourth,	Fifth, etc.
Adv. No.	4	6	2	9	1 etc.

Next, the chief reasons for choosing the order should be stated. This should be done in the light of introspection of the ways in which the several advertisements appeared in consciousness.

The results should be handed in, and then submitted to a member of the class for special study. The instructor should give suggestions as to methods of dealing with the materials statistically.

Possible methods of treatment and interesting values which may be determined:

(1) The distribution of judgments may be ascertained and indicated in tabular form.

Table of distribution of judgments for a class of twenty

Place		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Adv. No.	1	0	0	1	3	2	2	6	3	2	1
" "	2	5	6	2	0	3	3	1	0	1	0
" "	3	1	2	1	2	0	5	4	2	2	1
" "	4	1	1	4	2	8	1	1	0	0	2
" "	5	0	3	3	3	0	5	0	4	1	1
" "	6	2	0	1	0	5	0	1	4	5	2
" "	7	1	4	1	4	1	3	1	1	2	2
" "	8	1	1	1	2	0	1	1	1	2	10
" "	9	9	2	4	3	1	0	0	1	0	0
" "	10	0	1	2	1	0	1	5	4	5	1

This table indicates, for example, that adv. no. 1 was given first place by no one, that it was given fourth place by three individuals, seventh place by six, etc.

(2) From such a table of the distribution of judgments, the average order of merit of the advertisements may be determined. One way of doing this is to credit an advertisement with ten points every time it appears in the first place, with nine points every time it appears in the second place, with eight points every time it appears in the third place, and so on. Since, in the results from which the above table was constructed, an advertisement had twenty chances to appear in the first place, the maximum number of points which it could have to its credit was $20 \times 10 = 200$. As a matter of fact, no one of the advertisements reached this maximum. The actual results, or as they may appropriately be termed values, for the ten advertisements as determined by the method just described are as follows:

No. of Adv.	1	2	3	4	5	6	7	8	9	10
Value	89	154	102	124	112	86	116	67	170	80

Order of merit Nos. 9, 2, 4, 7, 5, 3, 1, 6, 10, 8.

(3) The closeness of the arrangement made by any individual to that made by the class as a group may be ascertained. A simple method of doing this is to credit the individual with one mistake for each place by which his ranking of an advertisement differs from the average. Taking the average or group order as 9, 2, 4, 7, 5, etc., the individual who placed adv. no. 9 in the third, instead of the first, place would be said to have made two mistakes—because he missed the average position by $3 - 1 = 2$ places. If he placed adv. no. 10 in the second place instead of in the ninth, his mistakes would amount to $9 - 2 = 7$.

For the twenty students whose judgments have been classified in our table the average number of mistakes was 18.7. The maximum number was 38, and the minimum, 8.

(4) The results for the sexes may be tabulated separately and the above values determined for each group, for the sake of comparison.

(5) Comparison of introspective data may be made in a class discussion of the exercise.

SUPPLEMENTARY READING

Titchener, E. B.: Text-book of psychology, §§ 85-104.
Witmer, L.: Analytic psychology, chapters 3 and 4.
Myers, C. S.: Text-book of experimental psychology, chapter 22.
Angell, J. R.: Psychology, chapters 6 and 7.
Calkins, M. W.: A first book in psychology, chapters 2 and 4.
Münsterberg, H: Pseudoptics (The Milton Bradley Company).

CHAPTER XV

PSYCHIC COMPLEXES: FEELINGS

"Every one of the bodily changes occurring in connection with an emotion, whatsoever it be, is felt, acutely or obscurely, the moment it occurs. If the reader has never paid attention to this matter, he will be both interested and astonished to learn how many different local bodily feelings he can detect in himself as characteristic of his various emotional moods. It would be perhaps too much to expect him to arrest the tide of any strong gust of passion for the sake of any such curious analysis as this; but he can observe more tranquil states, and that may be assumed here to be true of the greater which is shown to be true of the less. Our whole cubic capacity is sensibly alive; and each morsel of it contributes its pulsations of feeling, dim or sharp, pleasant, painful, or dubious, to that sense of personality that every one of us unfailingly carries with him. It is surprising what little items give accent to these complexes of sensibility. When worried by any slight trouble, one may find that the focus of one's bodily consciousness is the contraction, often quite inconsiderable, of the eyes and brows. When momentarily embarrassed, it is something in the pharynx that compels either a swallow, a clearing of the throat, or a slight cough; and so on for as many more instances as might be named."—James, Wm.: Principles of psychology, vol. 2, p. 451.

Affections and feelings.—Perceptions are complexes of sensations, and feelings are complexes of affections. In the preceding chapter we grouped all psychic complexes whose chief constituents are sensations, and in the present chapter we shall consider, in like manner, all experiences in which affection is predominant. Again we must remind ourselves that few experiences are exclusively composed either of sensations or of affections: our classification rests wholly upon the relative importance of these elements of consciousness. As the word perception may be used to denote the general class of sense-complexes, so we may use the term feeling to denote affective complexes.

The popular usage of the word feeling.—It is our wont to describe conditions within and without our bodies in terms of feeling. We " feel cold, weary, hungry, stiff, uncomfortable, calm, restless, annoyed, impatient." Such expressions obviously refer to conditions of our bodies, whereas we describe conditions outside us by saying that something " feels hard, heavy, rough, brittle, steady, safe." This usage is quite in accord with that intended in the title of this chapter. But whereas popularly we may designate all varieties of the affective complexes by the single term feeling, it is not convenient to do so in psychology. We may therefore proceed to distinguish the important kinds of feelings.

The chief varieties of feelings.—There are four classes of affective complexes which should be included in the generic term feeling. They are (1) sense-feelings, (2) emotions, (3) sentiments, and (4) volitions. Sense-feelings are sufficiently characterized by the fact that they are accompaniments of sensations or complexes of sensations, constituting the tone or value thereof. Emotions are complexes of strong sense-feelings which accompany perceptions or ideas. Sentiments are emotions which have acquired a connection with a particular object. Volitions are feelings which regularly culminate in a feeling of decision and are rather abruptly terminated with the expression of the decision. Each of these classes of affective experiences may now be examined more fully.

Sense-feelings and their properties.—For a sensation, a perception, or a memory to lack an accompanying feeling is the exception. Indeed so uniform is the association of affective elements with sensations and their complexes that the ordinary observer is likely to describe the sensation as a feeling. When we say that sandpaper " feels rough " we indicate that the affective elements of our experience influence us more strongly than do the sensation-elements.

Yet, analysis reveals the fact that the tactual sensations obtained when the finger is brought into contact with sandpaper are the chiefly significant parts of the experience so far as the psychologist is concerned. The popular phrase should, however, impress upon us the fact that consciousness of sandpaper consists of sensations plus important sense-feelings or affective elements. It may be said that we sense the sandpaper, and have a feeling for it. The former aspect of our consciousness is purely intellectual or cognitive, the latter is purely affective.

The more complex the group of sensations the more complex the affections.—An idea of pain may be accompanied by a vivid and insistent disagreeableness, but this sense-feeling is relatively simple in comparison with the affective elements which accompany the perception of an appetizing meal when one is ravenously hungry. The pain consciousness contains only a few elements of either the sense or the affective sort: the consciousness of the food is extremely complex in the number and relations of the sensations which enter into it and also in its affective constituents. Or, again, the perception of a color apart from an object is likely to be accompanied by a definite sense-feeling, but that feeling is almost elementary, in many instances, whereas the perception of a highly and complexly colored object is likely to be enveloped in a group of affective elements. It seems to be the case that the majority of sensations and common groups of sensations possess their characteristic feelings, and that the greater the number of these sensations or groups that are welded together in a given psychic complex the greater the number of affective elements in the experience.

Are there more than two kinds of sense-feelings?—It is readily discovered that there are at least two kinds of feelings connected with our sensations, perceptions, and

ideas. We call them feelings of pleasantness and unpleasantness when we think especially of our own bodily condition and feelings of agreeableness and disagreeableness when instead we think of the relation of something else to our bodies. This, however, is not an important distinction and it need not concern us further than to bring to our attention the fact that we sometimes refer feeling to ourselves, sometimes to other objects. Now, introspection indicates that sensations are separable into three classes with respect to their affective escorts. There are, first, those which are unmistakably pleasant, or agreeable; second, those which are as unmistakably unpleasant or disagreeable; and, third, those which have so little of feeling accompaniment that they must be described as indifferent. The sensations of certain modes are frequently characterized by being placed in one of these classes. The elements of the pain mode are usually unpleasant; those of the visual mode are usually pleasant. Of most varieties of sensation it is true, however, that the three relations to affection are represented. Some pain qualities are distinctly unpleasant, others are indifferent, and still others are slightly pleasant. To the popular ear it seems like a contradiction to say that a pain sensation may be pleasant, but introspection has convinced not a few observers that this really is the case. In the case of most experiences which involve pain qualities, what we notice is not the quality of the pain sensation or sensations, but, instead, the feeling which accompanies them. We thus come to confuse the pain itself with the sense-feeling which accompanies it under certain conditions. There is no mode of sensation in which the real psychic characteristics of the sense qualities are so obscured by their sense-feelings, so difficult to observe, and so frequently misunderstood as that of pain. The reader will do well to observe introspectively several color experiences, noting the sense-feeling which accompanies each, with a view to

finding out whether some colors are pleasant, some unpleasant, and still others indifferent.

Feelings of restlessness and quiescence.—As I hold my fingers above the keyboard of my typewriter, waiting for the proper word to come to the focus of consciousness, I experience a feeling which seems neither pleasant nor unpleasant. It is a consciousness of tension and restless expectancy. There is at times unpleasantness, but more frequently it seems unfair to characterize the sense-feeling by that term: it is more truly a feeling of restlessness. I seem to get this feeling mostly when after a decision, or after stimulation, something temporarily inhibits reaction. The feeling is distinctly one of strain and unrest. Perhaps it would be fair to say that this is the particular quality of unpleasantness which usually accompanies sensations of strain or the inhibition of movement. Almost the opposite of this restless feeling is that luxurious experience of calm relief which comes over one after a difficult act has been performed. Quite aside from the pleasantness of free and unobstructed activity I seem to discover in myself a sense-feeling of quiescence. Sometimes it follows activity; again it possesses me when there is no call for action. I have experienced it most vividly when after a satisfying dinner I settled into an easy chair for a half hour of relaxation before beginning work. I attribute the feeling to the general condition of the organism. Possibly, like the restless feeling, it too is merely one variety of pleasantness or unpleasantness. Only introspection can definitely settle this question and the more efforts at accurate observation are made in this connection the better for psychology and for our understanding of our psychological selves.

Emotions.—There is no variety of experience which is of such intense popular interest, so prominent in the constitution of mental life, and at the same time so important

and so interesting scientifically as those affective complexes which are known as emotions. In comparison with an emotion, a sense-feeling seems simple and readily understood. Yet there really is not as great a difference in complexity of structure as is often supposed; rather the difference consists in the vividness of the affective elements. We call an experience a perception, an idea, or a memory when the intellectual or cognitive aspect is predominant, and the same general experience we call a feeling or an emotion when the affective aspect is predominant. The first time you examined this book you experienced a perceptual complex, while as you examine the object now you have an emotional experience and that simply because the feelings of your consciousness are more prominent and stronger than the perceptions and ideas. As I looked up from this page I saw a leather-bound volume; I certainly perceived the book, but what I was intensely conscious of was an emotion of resentment, for the author of that book has written so carelessly that it is almost impossible to discover what he meant to say. I feel, each time I take up the volume, that I am being insulted, for the style indicates that the writer did not consider it worth while to take sufficient pains with his work to do it well.

Emotions are directed toward something.—It is characteristic of emotions that they are associated with perceptions or memory experiences. My resentment is directed toward a particular object. I am angry with a certain person. I am amused by a joke and laugh at it. I am sorry for my friend in misfortune. Every emotion is a more or less strong feeling for or against something. It may be my psychological or my physical self to which the emotion is referred, it may be some other self or some inanimate object or happening, but the reference is always there. Some psychologists content themselves by saying that an

emotion is a strong feeling and that certainly is true, but it seems to be more than that. The feeling is associated with a simpler intellectual content as a rule than is the emotion. I may feel the disagreeableness of a sudden fall in temperature or of having my face washed with snow, but I have no emotions attaching to the objects which are involved. If the fall in temperature, as I become conscious of it, is accompanied by an emotion it is likely to take the form of dissatisfaction with the person who had the care of my furnace or the engineer of the building, or of anger with that person because he has disobeyed or neglected his duty.

On the rise of emotions.—" The conditions under which an emotion arises will, then, be somewhat as follows. We set out with a consciousness, composed of a number of ideas, more or less distinct, and more or less pleasant or unpleasant. This consciousness is suddenly interrupted by an idea to which the attention is forcibly attracted (passive attention). The idea is immediately supplemented by other ideas, and a simultaneous association is formed, reflecting a scene or situation in the physical world. The situation is of such a kind that the organism, in obedience to biological law, must feel it to be pleasant or unpleasant. At this stage we have, therefore, a complicated feeling set in the midst of the original consciousness. The feeling is so powerful, however, that the original processes are now upon the verge of disappearance.

" An organism which is called upon to face a particular situation must do so by a particular bodily adjustment, a special bodily attitude or set of bodily movements. This adjustment is taking place at the same time that the complicated feeling, just described, is ousting the processes of which the original consciousness was composed. As it takes place, various organic sensations are set up,—the direct results of the changes in the position, tension, etc., of the

various bodily organs involved. These organic sensations associate to the mass of ideas contained in the feeling, and together with that feeling constitute the emotion.

"It is essential, then, for the formation of an emotion: (1) that a train of ideas shall be interrupted by a vivid feeling; (2) that this feeling shall mirror a situation or incident in the outside world; and (3) that the feeling shall be enriched by organic sensations, set up in the course of bodily adjustment to the incident. The emotion itself, as experienced, consists of a strong affection, and a simultaneous association of ideas, some of the part-processes in which are always organic sensations." (Titchener, E. B.: Outline of Psychology, pp. 229-231.)

The three phases of the formation of an emotion.—These phases are clearly exhibited in the following case. As I am lying on the beach enjoying the relaxation and exhilaration which follow an ocean bath and thinking of nothing in particular, a cry for help suddenly and unexpectedly breaks in upon my consciousness. In the quality of the voice itself there is something which prepares me for the scene which meets my eyes when I turn them toward the sea. A weak swimmer has been carried beyond his depth by the outgoing tide and is crying in terror for aid. My consciousness is instantaneously transformed from a purely and evenly associational affair to an emotional one, for a feeling of unpleasantness extremely vivid and insistent has broken in upon it. The feeling is one which has come to be associated with danger and death. My whole body responds to the situation instantly. My heart fairly jumps into my throat and beats with a speed which is double its usual; the perspiration comes out in beads almost before my muscles have brought me to the edge of the water. I am in a state of extreme muscular tension. Thus from these unusual bodily conditions, I receive sensations which are as unusual as is the feeling which called them

forth. They fuse in the total consciousness, which I describe as an emotion of horror. But this experience lasts only a moment, for the instant I have made up my mind what to do I am lost in the consciousness—purely intellectual—of effort to get to the drowning person. As I swim as rapidly and as steadily as I can in the proper direction, I am aware of many things, but predominant is the consciousness that I must keep calm and work steadily and hard if I am to be of any service. I know that the return of the emotion into which the cry of terror threw me would prove fatal to my aim.

Emotions interfere with action, when they are strong.—When in fear we act rashly or blindly. When in anger we act foolishly. When in extreme joy we act extravagantly. An emotion spurs us to action, but it must pass before we can act to best advantage.

Emotion and perception.—As Professor Thorndike very well says, "The emotions form in a sense a radically different group of mental facts [from the sensations, percepts, images, and other features of our life of thought]. Love, hate, fear, jealousy, anger, joy, sorrow, and the like, are feelings, not of or about things or bodily conditions recognized as such, but of one's own conditions, unreferred to bodily facts. They have, that is, a subjective or personal as opposed to an objective, reference. The emotional state of mind, in which one's own mental condition is paramount, is opposed to the intellectual state of mind, in which some object of thought is paramount. Besides possessing this subjective quality, the emotions are less subject to elaboration and manipulation than are sensations, percepts, and images. They do not connect with one another so as to form any system or order as do the feelings of things, meanings, and relationships. They are essentially isolated and incoherent. In the third place, we do not master them and use them at will for intellectual and prac-

tical ends as we do our ideas and judgments; rather they master us. For the time being one *is* the emotion." (Elements of Psychology, p. 74.)

Grades of emotions.—A persistent feeling, although not unduly strong, may yet be properly characterized as an emotion if the course of development outlined by Professor Titchener appears. In this case we experience a mood. It is a continued feeling of pleasantness or unpleasantness, or restlessness or quiescence. It colors the whole of our consciousness, cognitive as well as affective, for a period of time. We have times of depression when no good fortune counts for much and when any bad luck casts us into the depths of despondency. And again we have periods of cheerfulness when even a serious misfortune seems trivial. These moods are characteristic of what is called the temperament. We shall consider them in the following paragraph. There are three readily distinguishable grades of intensity in emotion: moods, ordinary emotions, and passions. A passion is the opposite of a mood. Unlike the latter it is extremely intense and also short lived. Because of its great intensity it can not last long. Indicative of the four grades of emotion which we habitually distinguish in speech are the following affective terms:

MOOD	WEAK EMOTION	STRONG EMOTION	PASSION
Wonder	Surprise	Astonishment	Amazement
Irritation	Aversion	Anger	Rage
Kindliness	Friendliness	Liking	Love
Chagrin	Mortification	Resentment	Exasperation

In general it may be said that the stronger or more intense the feeling which breaks in upon the unemotional consciousness the more numerous, vivid, and intense the

bodily sensations which it arouses and the stronger the emotion which is experienced. The receipt of an interesting and friendly letter from an old acquaintance may give rise to an emotion of cheerfulness, which may persist as a mood or develop into an experience of delight. Its duration is almost certain to depend upon its strength. Those persons who are prone to violent emotions pass into them quickly and as quickly emerge from them. They lose their tempers almost instantly upon provocation, fly into a rage for a moment or so, and emerge from it almost before the person who has been the cause of the emotion has got well started toward an emotion of resentment. Passionate individuals are wont to be surprised because after they have recovered from their anger toward a person that person is likely to be at the height of his emotional experience and can not be placated. This is an important individual difference.

Psychological temperaments.—As there are eye-minded, ear-minded, and touch-minded individuals among us, so also are there moody, even-tempered, and passionate persons. As a rule, however, we distinguish only two types of individual by strength of emotion and two by quickness of emotional response. These familiar classes of temperaments are:

The choleric—characterized by strong feeling and quick thinking and acting.

The sanguine—characterized by weak feeling and quick thinking and acting.

The melancholic—characterized by strong feeling and slow thinking and acting.

The phlegmatic—characterized by weak feeling and slow thinking and acting.

It is an interesting and not altogether profitless exercise to attempt to arrange one's friends and acquaintances in these temperamental groups!

The bodily accompaniments or expressions of the emotions.—At one time a considerable stir was caused among psychologists by the assertion that bodily conditions are the causes of emotions. Professors Lange and James expressed this idea in somewhat different ways. What they both emphasized was the fact that apart from the bodily conditions which regularly attend an emotional experience the experience itself is negligible. They reversed the usual order of facts and stated that we are angry because we clench our fists, look unfeeling, have rapid heartbeat, are warm, etc. That we feel sad because we express sorrow instead of the reverse. This way of putting an important fact of observation misled many persons into thinking that our emotions are nothing except the sensations of bodily conditions which accompany the responses to certain situations. This is not the whole truth. The response which we make to a given situation has a great deal to do with the nature and duration of the emotion which we experience but it does not wholly determine it. For in the first place, the feeling which primarily interrupted the train of thought is not a product of bodily sensations. It appears, is responded to, and immediately is supplemented by the sensations arising from our bodily condition. There is, however, a great deal of truth in the statement that we do not experience anger to any considerable extent when we suppress the so-called bodily expressions of the emotion. As a matter of fact it is utterly impossible wholly to suppress the bodily conditions and visible expressions of a given emotion. Could we do so, we doubtless should not experience the emotion. What we can do to a limited extent is to control these expressions. We find that when we do so the emotion is lessened in strength and is of diminished duration. Indeed, if, in the face of a situation which is wholly calculated to call forth anger, I merely laugh and make light of the circumstances I do not experience anger

to any marked extent: I may even experience another kind of emotion. Thus it happens that persons experience very different emotions or the same emotion in different ways and in varying degrees under the same circumstances. The fact is that the bodily sensations accompanying what we do in the face of any situation which tends to call forth an emotional response are essential parts of the emotional experience.

Sentiments are emotions which, like moods, tend to last.—A sentiment has been defined as an emotion which attaches itself to a particular object. For the home of my childhood I have a sentiment: I can not return to the place even in memory without experiencing an emotion of mixed nature, the prominent characteristic of which is its duration, and its permanency of reference. It is the feeling which I have for that particular place. Similarly, the emotion which I experience on seeing a very dear friend is a sentiment for it belongs to my consciousness of that individual. It seems then, that a sentiment is an emotion which has come to be definitely attached to a particular thing and seems to belong to it. It differs in no other essential respect from other emotions, except that it usually involves a judgment or complex intellectual act.

Four classes of sentiments have been distinguished: the intellectual, the ethical, the religious, and the æsthetic. These sentiments arise respectively in connection with situations which demand judgments concerning what is true (logic), good (ethics), beautiful (æsthetics), or right in the divine plan (religion).

Volitions.—The last of the four types of affective complexes mentioned at the beginning of this chapter is volition. "Every emotion," says Professor Wundt, "made up, as it is, of a unified series of interrelated affective processes, may terminate in one of two ways. It may give place to the ordinary, variable, and relatively unemotional course

of feelings. Such affective processes which fade out without any special result, constitute the emotions in the strict sense. . . . In a second class of cases, the emotional process may pass into a sudden change in ideational and affective content, which brings the emotion to an instantaneous close; such changes in the sensation and affective state which are prepared for by an emotion and bring about its sudden end, are called volitional acts. The emotion together with its result is a volitional process.'' (Outlines of Psychology, p. 203.) This will serve us as a definition of volition, as far as the feeling involved is in question. But the affective portion of the volitional process is only one part of a very elaborate psychic complex. We must not fall into the error of supposing that the whole of will may be described under this head. There is a definite kind of feeling accompanying every will act, and it is appropriate to mention it as a type of affective experience, since it is markedly different from sense-feelings, moods, emotions, and sentiments. The feeling of hesitancy is as unlike what we have been examining in the previous paragraphs as is the feeling of decision. It is the latter which abruptly terminates so many of our emotional experiences and sets us forth upon a new course. Indeed, the chief characteristic of a volition would seem to be precisely what Professor Wundt has pointed out as its tendence to pass suddenly into something else. I feel determination and forthwith the nature of my train of thought and my feelings changes.

Every judgment really involves a volition.—No judgment is utterly intellectual for there is always present at some stage of the process a volition. There must be a feeling of certainty or of uncertainty, or of partial certainty. A feeling of satisfaction accompanies the formation of the judgment, but this is not to be confused with the feeling for the judgment which is really a part of the intellectual process.

CLASS EXERCISE

Self-observation. The affective values of a set of advertisements. Materials: the same set of ten advertisements used in the exercise described at the end of chapter XIV.

This exercise may be conducted either with the class as a group or by the individuals out of class. The former method is recommended.

The instructor should arrange a screen, similar to that used in connection with the experiment on the affective values of colors, in which two windows permit the exposure to view of two full-page advertisements. This screen should be so placed that each member of the class can see the two advertisements clearly.

A number of blank tables like the one used in the color exercise (page 157) should be prepared in advance either by the instructor or by the students. In these tables the results of the experiment may be rapidly recorded.

The instructor, having made clear the purpose and method of the exercise, begins by exposing to view for five or ten seconds adv. no. 1 with adv. no. 2, at the same time asking, "Is no. 1 more or less agreeable than no. 2?" "If the former, record the judgment by placing a plus in the upper space of the vertical column which is headed by 2 in the blank form; if the latter, enter instead a minus." Next, no. 1 is shown with no. 3, then with no. 4, and so on. In this case, as in the exercise with colors, the advertisement which is being compared with the remainder of the set should always be exposed in the same window—say, the one on the right of the observer.

As soon as each advertisement has been compared thus with every other, and the table of judgments completed, the instructor should repeat the series under slightly different conditions, by placing the advertisement to be compared with the others in the window on the left of the observer. Thus two series of judgments may be obtained.

At the conclusion of the exercise the results should be delivered to a student for special examination and report.

Points to be brought out in this report are (1) the order of preference—from most to least agreeable—for each individual, as determined by adding the judgments of the two series; (2) the average order as obtained by considering together the results for all the members of the class; (3) the departure of each

individual from this average order; (4) the reliability of the results; (5) a comparison of the ranking of the advertisements according to affective value with the previous ranking according to first impression of excellence.

Immediately after this exercise, each student should write a full introspective report of the work, attempting to describe the characteristics of the affective consciousness.

SUPPLEMENTARY READING

James, Wm.: Principles of psychology, vol. 2, chapter 25.
Titchener, E. B.: Text-book of psychology, §§ 128-137.
McDougall, Wm.: Social psychology, chapter 3.
Thorndike, E. L.: Elements of psychology, chapters 5 and 6.

CHAPTER XVI

PSYCHIC COMPLEXES: MEMORY AND IMAGINATION

The following introspective account of a chess game was written by Professor E. E. Southard. Some twenty minutes after the completion of the game in question Professor Southard replayed it as a blindfold game, and he thereupon wrote down the introspections which are here quoted.

A RECORD OF INTROSPECTION FOR CHESS IMAGERY

I. THE GAME

F. J. M., WHITE	— E. E. S., BLACK
1. P-K4	P-K4
2. P-Q4	P x P
3. K Kt-B3	K Kt-B3
4. P-K5	Kt-K5
5. Q x P	Kt-B4
6. KB-B4	Kt-B8
7. Q-KB4	Kt-K3
8. B x Kt	QP x B
9. Q-Kt3	Kt-K2
10. Castles	Q-Q4
11. Kt-B3	Q-B5
12. [B-Kt5] [1] Kt-Q2	[Kt-B4] [1] Q-B3
13. [Q-R3] [1] Kt-Kt3	Kt-B4
14. Q-R3	P-QKt3
15. B-KKt5	P-KR3
16. QR-Q	B-Kt2
17. P-KB3	P x B
18. Q x R	[Q-B4] [1] Kt-K6
19. Kt-Q4	Q-B[4] [1]-5
20. Kt (Q4)-Kt5	Kt x KR

[1] Errors in transcription shortly afterward rectified.

21. R-Q4	Q-B4
22. K x Kt	B-R3
23. R-Q3	B x Kt
24. Kt x B	Q x Kt
25. Resigns	

II. REPRODUCTION OF GAME

"Move 1. Auditory............with repetition of image, twice.

"Move 2. Now what............op...ing? Visual image: vague sense of position *vis à vis* in atmosphere somewhat darker than it actually was. *White? Black?* (rising inflection) very faint *O yes.* Center G...bit.

"Visual image of M.'s pawn at King's Fifth (as per fourth move, but seen at some time in the game subsequent to Black's eighth move, as there was a dim image of White's King's pawn confronted by Black's pawn at King's Third) and also of some pawn at White's right side, possibly King's Rook's pawn (which in point of fact remained unmoved up to White's resignation), with vaguest possible image of some pawn of Black's on his Queen's wing. The blackness and whiteness are imaged as of the bullet-like tops of the pawns. Sense of a visual something else besides the pawns seen. Squares of board not seen, yet the pawns are distinctly enough oriented in space as in front of an extremely vague *propria persona* (itself in this case not analyzable). Then the move 2. P-Q4 is set down forthwith without analyzable image. P x P is accompanied by vague auditory repetition (ecks P, ecks P). This last is an habitual thing with me when the sign x (i.e., "takes") is clearly seen, based on a former whimsical wonder why the sign x was adopted. Parenthetically, I may say that, whenever I am rather lazily reading and let my mind wander from the subject matter, fantastic ideas, compounded of visual and auditory, are apt to center upon the printed letters (inadequate efforts after some kind of symbolism).

"Move 3. KKt-B3 is set down after an auditory image, attended by a fleeting visual image of the Kt posted diagonally back of the pawn at King's Fifth, both seen quite out of relation to any board or anything else save something vaguely massed behind to the left and before somewhat farther away.

"Black's reply was for the moment in doubt. 'Doubt' equals a slight feeling of tension with possibly the vaguest schematic visual image of two dog's ears pricked up (my habitual doubt symbol). A sudden sharp visual image like that above (Knight in relation to pawn) shot in. Perhaps a kaleidoscopically sudden fresh image of the Black's King's Knight attacked by White's King's pawn, as under move 4, entered. At all events the reply to KKt-B3 followed at once without remembered image. Overlapping those images (I do not make out whether originating before or after the doubt just mentioned) another contest set in in my mind, namely, whether I should write KKt-B3 or Kt-KB3. This alternative presented itself as a visual image

in which the initial K of the phrase KKt-B3 and the second K of the phrase Kt-KB3 were the best lighted parts. The auditory image 'German notation,' 'Why not,' 'Why,' entered (I have never settled whether I preferred to use the German or the English notation in transcribing games). This question was shortly dismissed by a process of unremembered character in which possibly an auditory image 'sil' (presumably of the word "silly") appeared. Many of my mental meanderings I am inclined to terminate in this way. Thereafter the question of notation failed to appear throughout the transcription.

"Move 4 was mechanically set down with a brief visual image of the Knight hovering over King's Fifth before being set down. Here is the first possibility of a kinæsthetic image. I am not sure whether there was or was not a kinæsthetic element here. As I try to reproduce the image, I seem both to feel something, curiously enough, in right upper arm muscles (a feeling most nearly resembling a pressure skin sensation plus something else) combined with a visual image of a moved dark long object, on arm presumably, running from right to left toward the Knight in question. All such movements are reproduced in memory as of the right arm, though in actual play the left may be used for pieces and pawns nearer the left hand. As a matter of fact by repeating the moves, I can remember that the piece was actually moved by the left hand: in so reproducing the fact, I get a distinct kinæsthetic image referred to the left upper arm, below and externally, apparently rather superficially in the arm.

"Move 5 was set down mechanically, except that the Knight at QB4 and a vague tall something (the Q at Q4) were held in mind for some little interval and a sense of recognition appeared. There was apparently a brief auditory image 'oth'....of the term 'other,' possibly referring to another period. This 'oth...' was attended by the distinct auditory image 'Barry,' being the name of a player with whom I had formerly had (several years before) a similar confronting of pieces. No further use was made of this memory.

"Moves 6, 7, 8, were transcribed rapidly with brief but continuous visual imagery in which the pieces were not seen as such or at all outlined, but seemed to go too swiftly to be seen, although adequately recognized.

"Move 9 found me wavering between Q at KKt3 and Q at KR3 (the latter an illegal move). I saw somewhat clearly this corner of the board as it appeared in actual play at move 14. Then the actual move Q-Kt3 was set down without further ado, without, apparently, any form of imagery.

"Delay ensued over 9.....Kt-K2, and a quick succession of brief visual images of later positions (only two or three pieces seen) was succeeded by an emphatic writing down of the move.

"At this point I made an error in the transcription, setting down 12. B-Kt5, Kt-B4, 13. Q-R3 instead of the actual continuation 12. Kt-Q2, etc. And in rectifying my error I wrote 12. Kt-*K*2 instead of the correct Kt-Q2, in my haste to get the right move noted. This *K* apparently came in a brief auditory way from the fact that it was the King's Knight that was moved instead of the Queen's.

"The following moves were reproduced very rapidly by the visual route, accompanied by a faint euphoric or exultant feeling, which seems to be with me a slight sense of motion, or warmth (?), in my cheeks, as if from a beginning smile. If reproduced at all steadily, I get a feeling referred to the skin of the lower eyelids, apparently gotten by opening the eyes wide. There was a sense of lack of resistance and an easy flow—combined visual imagery and equilibrated feeling as of one in a boat moving from right to left. 16.....B-Kt2 was reproduced visually but with an attendant kinæsthetic image of something going on in the under surface of the right forearm or in the hypothenar eminence of the right hand—and something going on rapidly.

"Following moves mechanically and swiftly reproduced until 19, when doubt set in, this time without sensations like those 'doubt' sensations set down under move three. Instead there was a curious combined visual and kinæsthetic image as of some object of a snout-like character moving about in the region of the chessboard in question (possibly survival of images got from a picture of Bœcklin's).

"19......Q-B5 was transcribed erroneously at first as Q-B4 and in move 20 I wrote down Kt(Q4)-Kt5 instead of the more strictly best notational form (KKt-Kt5), as I did not for the moment remember whether the Kt in question was the King's Knight or the Queen's. I got a faint kinæsthetic image of a shake of the head referred, on no proper mechanical principles, to the two temples 'seen' or felt from behind and above. Parenthetically I may say that my kinæsthetic imagery seems to have little relation to the anatomical situation of the proper muscles, but is rather referred by preference to some external surface. It is also frequently accompanied by visual imagery. The localization, as such, seems to be largely a visual affair.

"The remaining moves were recorded instanter without visual accompaniments.

"The time taken for writing down the moves as above was eleven minutes. The time for writing these remarks, one hour, forty minutes. (Manuscript.)

New and old experiences.—The first time an elementary mental process or a psychic complex enters consciousness it is new to that consciousness; the next time it enters it is old. Practically we distinguish the new from the old by saying that certain experiences are novel and unfamiliar to us while others are mere repetitions of what is familiar. These two varieties of experience: what we are aware of for the first time and what we recognize as having previously formed a part of our mental life, are often called the presentative and the representative aspects of consciousness. Evidently the mere fact of repetition or reappearance

in consciousness does not constitute an experience a remembered experience. It must be recognized as old, it must be accompanied by a feeling of familiarity.

Elements as well as psychic complexes may seem either new or old to us.—After a particular quality of sensation or of affection has been experienced once, it may upon recurrence be recognized as identical with or similar to the previous consciousness. In that event, it is no longer a simple psychic process, for the feeling of familiarity is an essential part of the experience. For this reason no memory experience, no represented consciousness, is simple and elementary; it may be analyzed into that which is remembered or recognized and the recognition consciousness. Nevertheless, it is convenient and desirable to distinguish new mental elements from old, and new mental complexes from old.

Sensations and affections are of two kinds.—A sensation which appears in connection with the stimulation of a bodily sense organ is known as an impression. When it appears apart from any disturbance of the sense organ it is known as an image. We may experience sensations of red, of sweet, of warmth, in a situation which enables us to attribute the sensations to disturbances about us, or in circumstances which enable us to say only that we are conscious of the sensations. These facts we express by saying that we see red, we have an image of red, or we remember red. Similarly we may re-experience any sense or feeling quality which we have previously experienced. An image of a sensation or affection is quite impossible unless the sensation or affection has been previously experienced. A person blind from birth is incapable of experiencing visual images: incapable indeed of having visual ideas. Sensations are present in consciousness in two forms: (1) as presentative experiences (impressions), and (2) as representative experiences (images). It is not as

certain that affections are ever re-lived as images, but the writer suspects that they are sometimes.

Not every represented experience is remembered.—Whether it be a simple or a complex experience which is repeated in consciousness, it may possess or it may lack the characteristic mark of memory. Nothing is remembered unless it is recognized. This means that it must be accompanied by a feeling of familiarity. It matters not how many times I see an interesting face in the car as I ride to and from town, I may not say that I am remembering a previous experience of the face unless I definitely recognize it, refer it to a more or less definite place in my past mental life, and feel familiar with the present experience. There are mistakes of both sorts in this connection. Sometimes we fail to recognize an old and often repeated experience, and at other times we recognize, with a strong feeling of familiarity and certainty, an experience which later turns out to be new to us. The one of these errors is about as disturbing and humiliating as the other.

Cases of erroneous recognition.—The other day I was stopped on the street by a stranger, addressed most familiarly, and asked whether I did not remember Mr. D. I did not, nor could I, and when I explained my identity, the gentleman was as much surprised as he appeared to be annoyed. To him had come an experience which bore all the ear-marks of memory, yet it really had no claim to those marks, for he convinced himself that he had not seen me before. The explanation for this variety of error is simple. We mistake a person who is strikingly like another for the latter because of points of resemblance. We are misled, and at times it is almost impossible to convince ourselves that we have not previously seen or met the individual. The same explanation applies to all sorts of experiences in which the new seems to be old. The truth is we come to recognize a situation by some one or a few

of its important features and when they happen to reappear in some other connection we are likely to confuse the one experience with the other.

Failures to recognize.—All of us are familiar with failures to recognize when we might reasonably be expected to do so. There are individuals who may gaze intently upon your face time and time again, and talk with you, and yet fail to recognize you a few days later. To such individuals it would seem that the human race must prove infinitely varied! Likewise some of us may read a passage, a poem, or even a book twice at considerable intervals without becoming aware of our previous experience. The extremes in this direction are rare, but the more commonplace instances of failure to recognize are myriad.

Memory images.—The truth is that almost none of our concrete experiences are either wholly new or old. Instead they consist of a complex of presentative (impressions) and representative (images) bits of consciousness. The total effect may seem either new or old according to the nature of the preponderating elements. A perception contains as a rule fragments of consciousness which are recognized as old, or would be so recognized if they should be examined introspectively. But that is the point. When we remember we are aware of the feeling of familiarity in the experience, whereas when we perceive we are more likely to be occupied with the immediately given sensations and affections of the experience. Yet even these may seem familiar to us. The rows of books before me I have perceived day after day for months and years as I have sat at my desk writing, but to-day, as the first time I looked upon them, they are borne in upon me with a certain freshness and novelty which is characteristic of experiences which are made up largely of impressions. The impressional sort of experience is likely to be clearer, more vivid, than the imaginal experience. When I turn my eyes

from the bookcase and remember the appearance of the objects I have an idea of them, but the experience is in a variety of respects different from the perception which I experienced a moment ago. Both hold the ear-marks of recognition, for long dwelling on the sight of the case has made it a part of my life, but the perception seems more impelling, intense, clear, than does the idea.

Each perception in reality consists of impressions and of images, for in looking at an object with which we are familiar we seldom see or otherwise directly receive all of the sensations and affections which enter into our experience. Some of them are supplied from previous experiences. Thus, as I look at the sheet of paper before me my consciousness of it includes certain sensations of touch and temperature, if not also certain affective elements, which introspection tells me are brought from my previous experience of the paper. I am not touching it now so I have no impression of touch, yet I am aware of that property of the object, for I have a touch image. The part played by past experiences in the constitution of a perceptual experience varies greatly with individuals and with circumstances. Some persons are conscious almost solely of what is at the moment received in the shape of sense-impressions, others are conscious to a great extent of images from previous experiences of the same object or of like objects.

Images in dreams.—Images of both the sense and the affective type appear in dreams. Often they are very vivid and can be introspected readily on waking. Not a few individuals who are unable to discover certain kinds of images in their ordinary memory consciousness note them in dreams. The writer, for example, although ordinarily unconscious of auditory images in his experiences, has observed remarkably vivid ones in his dreams.

The introspection of one's dreams thus provides a method

of gaining much valuable information concerning images. Professor Calkins[1] has complied the following table of the frequency of occurrence of various types of sense images in dreams:

Observer	Number of dreams		Visual	Auditory	Dermal	Gustatory	Olfactory
S	133		85.0%	57.1%	5.3%	0.0%	1.5%
C	165		77.0	49.1	8.5	0.0	1.2
W	141		100.0	90.0	13.5	12.0	15.0
B	150		72.7	54.6	6.0	2.7	2.7
Total	589	Average	83.2%	62.1%	8.3%	3.6%	4.9%

This table indicates the percentage of dreams, in the cases of four observers, in which visual, auditory, dermal, gustatory, and olfactory images appeared.

Ideational types and types of memory-images.—The expression ideational type may be used to refer to the variety of sense or affective experience which preponderates in the individual. It may not refer specifically to either the presentative or the representative experiences of the individual. For if the visual elements of experience are of paramount importance to us, they are likely to appear both in our perceptions and our memories. We might, to be perfectly definite in our statements, speak of perceptive, ideational, and memory types. For thus we could refer to the particular variety of experience in question.

Suddenly some one shouts the word " telephone." What happens in your consciousness? If you are a visualizer you will probably see more or less clearly the telephone you are accustomed to use, or the one nearest at hand, or the one to which you happen to know reference is intended. The details of your visual images of the telephone-

[1] Calkins, M. W.: Introduction to psychology, p. 400; *American Journal of Psychology*, vol. 5, pp. 311-343; also Weed, S. C. and Hallam, F. M.: *American Journal of Psychology*, vol. 7, pp. 405-411.

situation may include yourself at the telephone and the surroundings, yet it may not go beyond what you could see if you were in the presence of the object. Your consciousness is predominantly visual and your imagery is therefore called visual.

If, instead, you are of the auditory type you will doubtless become conscious of the sound of a conversation over the telephone. Perhaps of the last you had. Auditory images will stand forth in clearness, whereas all other images will form merely the background of your experience.

If you are a tactual-motor individual, you will feel the articulatory movements necessary for the pronunciation of the word telephone, the feelings which you get in holding the receiver and in so moving your lips, tongue, larynx as to express certain words. In a word, your imagery will be chiefly tactual and motor for you will feel bodily changes instead of seeing or hearing the situation.

If you belong to the mixed type, you are likely to have all kinds of sense (and affective?) elements present in the imagery. No one kind of element will be predominant. Certain features of the situation will appear visually, perhaps indistinctly and scarcely recognizably, others will appear auditorily, still others tactually or in terms of movements, there may even be traces of taste or smell images. As a rule individuals belonging to the mixed type possess nothing so clearly defined that it is easily recognized as a sense or affective image.

Galton's investigation of imagery.—Many years ago the attention of a wideawake, keen observer of living things and of the conditions of life, who, although not a professional psychologist, has done more to advance our knowledge of human characteristics than most psychologists, was drawn to the matter of differences in remembering. This gentleman, Sir Francis Galton, was struck by the fact that whereas his scientific acquaintances almost to a man

emphatically denied clear visual imagery, ordinary folk much more frequently admitted that kind of experience and took satisfaction in describing it for him. This observation led Galton to an extended inquiry into the subject, an interesting account of which is to be found in his "Inquiries Into Human Faculty" under the heading "Mental Imagery."

By questioning hundreds of persons of different ages, sex, and occupation, Mr. Galton discovered that a large number of persons have extremely clear and varied mental pictures of things. It was his method to ask a person to remember the breakfast table and to describe his consciousness. Some individuals see the object with the mental eye, others do not see it at all. Inability to see things mentally is especially prevalent among men of science and those who deal with abstractions—philosophers. Of them Mr. Galton writes "To my astonishment, I found that the great majority of men of science to whom I first applied protested that mental imagery was unknown to them, and they looked on me as fanciful and fantastic in supposing that the words 'mental imagery' really expressed what I believed everybody supposed them to mean. They had no more notion of its true nature than a color-blind man, who has not discerned his defect, has of the nature of color. They had a mental deficiency of which they were unaware, and naturally enough supposed that those who affirmed they possessed it were romancing."

Our individual characteristics of memory.—The attitude of these scientists concerning mental imagery is not unlike that of most of us when we are presented with a keen and penetrating example of introspection. We are surprised, dubious, even incredulous of the results of a person's introspection because we find nothing to correspond in our own experiences.

The study of the science of psychology should teach us

to judge carefully and with full recognition of the following important facts: (1) that not all persons have the same experiences, and (2) that individuals differ as greatly in introspective ability and skill as in their experiences. There was a time when clear visual imagery seemed to me fictitious: I did not experience anything of the sort myself and I doubted whether any one else did. My attitude has changed completely for I now recognize that my way of remembering things is as markedly different from that of the majority of persons as is that mind which lacks visual imagery from that one which has it vividly and in abunance. If we would be successful psychologists we must be open-minded and charitable, we must accept observations, upon sufficient evidence of care and competency, even though we can not verify them in our own experience.

Number-forms and similar groups of visual images.—It was Francis Galton who first brought into clear light the important fact that some persons have peculiar and individual ways of representing certain matters to themselves. While the majority of us, members of the common herd as we are, have no especially interesting experiences when we think of the numerals, the days of the week, the names of the months, or of the seasons, there are individuals who regularly experience these facts visually and in odd ways.

Two of the number forms described in Mr. Galton's book are reproduced in Fig. 4. But since these drawings give a very inadequate knowledge of the nature of such types of imagery a case may be more fully described.

Imagery of the months.—Mrs. Yerkes has written the following description of her manner of picturing the months and seasons.

"The form which my mental image of the months of the year takes may be described roughly as a letter U. The left arm of the letter is continued, however, in a curve to

the right and then downward until it ends abruptly about two-thirds of the way to the bottom. It is, moreover, not all in the same plane, for the arms slant backward as well as upward, as if resting on a hillside, while the horizontal portion lies flat on the ground at the bottom.

"My own view of this figure is always obtained from that position on the figure which the present moment occu-

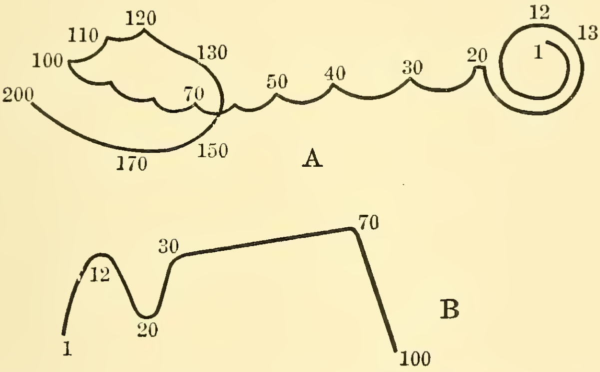

Fig. 4. Examples of visual number forms. (After Galton.)

pies. Suppose, for example, that this is a day near the end of January. My own position is therefore around the turn at the top and part way down the middle line of the figure. In looking forward to the year, I look forward and downward to the end of March where an abrupt break occurs; the first of April I see over on the hill-top at a point slightly higher than that where I now stand, and at the beginning, as it were, of another road running parallel to this, downward, but some distance away. July and August I see curving around below me on the level ground, connecting the downhill road of spring and the uphill one of autumn. One further point may be mentioned here: this road on the plain is always flooded with sunshine which pales on

the hill roads till the winter months are somber, though, oddly enough, March seems the dullest of all.

"This effect of sunshine is apart from the color of the month and both are distinct from the color of the names of the months themselves. The two former points are connected rather with their relation to the year as a whole. The month July, for example, is bathed in sunshine; the name July, on the other hand, calls up hues of blue verging on violet; April is pale yellowish-green in color (associated with daffodils), May is a deeper green but with flecks of pink (apple-blossoms) and June is a cool deep green. The name April, however, is chiefly white owing to the dominance of the long sound of 'a' which always has that association for me; the name May is pink. The name June agrees with the color of the month, possibly because the letter 'n' is also green. I might add here that in their relation to the year as a whole the rest of the months are less definite in color. Four of them are seen in varying shades of gray; of these December is the lightest, then September, November, and March. February, August, and October are shades of tan ranging from light to dark in the order named.

"I have spoken of the course of the months as a road; it is so only in that it leads me somewhere. It has none of the other attributes of roads, such as earth, grass, trees, or buildings, though my image of the month is often accompanied by a swift glimpse of some appropriate scene, either imaginary, composite, or plainly remembered. The days of the month are rather like a succession of numbers; usually when I think of a single date in the month all of the days are in a continuous procession. The weeks then are distinguished from one another though I can not tell exactly how; the vagueness is doubtless due to the variation in the day of the week with which the month begins. When, on the other hand, I think of the month as a whole, some-

times the days are grouped in weeks which occur in horizontal parallel rows as in the average calendar.

"Along this winding road the important anniversaries of the year stand out like milestones. Not that there are any marks by which to distinguish them in my mental picture; the numbers are no larger or blacker but they stand out more clearly. The most prominent ones are those associated with my early childhood—Christmas and New Years days, the Fourth of July, and my own birthday.

"As the year progresses I advance with it till at the first of August I stand at what is to me the middle of the year, for in the figure July and August occupy symmetrical positions, June and September, May and October, April and November. With December begins the unsymmetrical extension; the greater part of the turn is occupied by that month and it is completed by the first few days of January. It is one of the oddities of the figure that I never have any difficulty in bridging the gap between the thirty-first of March and the first day of April. It is jumped automatically in the night." (Manuscript.)

Importance of knowledge of this imagery.—The variety of such particular and highly individual imagery is great and its value can not be fairly judged. Most persons who have such experiences either do not know that they are exceptional or are troubled by the notion that they are abnormal. Witness the following quotation from one of Galton's correspondents. "I had no idea for many years that every one did not imagine numbers in the same positions as those in which they appear to me. One unfortunate day I spoke of it, and was sharply rebuked for my absurdity. Being a very sensitive child I felt this acutely, but nothing ever shook my belief that, absurd or not, I always saw numbers in this particular way. I began to be ashamed of what I considered a peculiarity, and to imagine myself, from this and various other mental beliefs and

states, as somewhat isolated and peculiar. At your lecture the other night, though I am now over twenty-nine, the memory of my childish misery at the dread of being peculiar came over me so strongly that I felt I must thank you for proving that, in this particular at any rate, my case is most common." (Inquiries Into Human Faculty, p. 113.)

Herein we have another proof of need of openmindedness and willingness to give serious attention to experiences which are foreign to our mental life.

The use of imagery in exceptional cases.—Prodigies of various sorts are known to depend, in many instances, upon a remarkable power of visualization. This is true of a number of mathematical prodigies who are able to do mentally mathematical feats which are difficult and time-consuming for the ordinary person. To be able to see clearly before one the numerals 187,293,047,890 and 328,790,-283,289 and the several lines of digits which would result in the case of long-process multiplication, and to read with the mind's eye the product is indeed a remarkable feat from the point of view of most of us. It is, however, possible to those individuals whose visual images are exceptionally clear and persistent.

The imagery of the blind, and of the blind and deaf.—Those unfortunate individuals who from birth lack the senses of sight and hearing often possess mental imagery which is extremely interesting. Miss Helen Keller, who although deprived of sight, hearing, and the power of articulate speech, is highly educated and closely in touch with the world of human events, writes most illuminatingly of her imagery and of her sense experiences. "It is not for me to say whether we see best with the hand or the eye. I only know that the world I see with my fingers is alive, ruddy, satisfying. Touch brings the blind many sweet certainties which our more fortunate fellows miss, because their sense

of touch is uncultivated. When they look at things they put their hands in their pockets. No doubt that is one reason why their knowledge is often so vague, inaccurate, and useless." . . . "I know by smell the kind of house we enter. I have recognized an old-fashioned country house because it has several layers of odors, left by a succession of families, of plants, perfumes, and draperies." . . . "From exhalations I learn much about people. I often know the work they are engaged in. The odors of wood, iron, paint, and drugs cling to the garments of those who work with them. Thus I can distinguish the carpenter from the iron-worker, the artist from the mason or the chemist. When a person passes quickly from one place to another I get a scent impression of where he has been—the kitchen, the garden, or the sick-room. I gain pleasurable ideas of freshness and good taste from the odors of soap, toilet waters, clean garments, woolen and silk stuffs, and gloves." (Keller, Helen: Sense and Sensibility, *The Century Magazine*, vol. 75, pp. 566-577.)

Touch, smell, taste, and the sensations of movement and of bodily condition count for everything in the perceptions and ideas of such individuals. What we see actually, or in our mind's eye, they perceive or image in terms of the other senses. Miss Keller's imagery is chiefly tactual-motor and olfactory, but it is almost impossible for us to imagine what it is like, so different is it from our own.

Imagining.—We are said to imagine not when we merely have images, but when our imagery is of such a nature that our experiences seem to us new and original. Imagery which is repetitional of previous experiences and which has the feel of familiarity we class with memory experiences; that which shares in an experience which seems unfamiliar, new, is classed with imagination.

Because of this important difference memory and imaginative experiences have been grouped together under the

general term imagination and two varieties of imaginative experiences have been described. The first is reproductive, the second is creative. Reproductive imagination is memory. Creative imagination is what is usually spoken of as imagination. Thus far in our discussion we have considered memory. We must now examine the properties of experiences of creative imagination.

What are the materials imaginings are made of?—In memory experiences we recognize the same varieties of conscious elements which we have found in presentative psychic complexes: sensations and affections, but they are in the form of images instead of impressions. The same is true of our ideas. Now, in imaginings there exist the same materials, with the exception of the recognition consciousness and its feeling of familiarity. An imaginative experience may involve a complex of visual, auditory, and taste images, together with affective elements and feelings, emotions, or sentiments, many of which have been experienced vividly and often in other relations, but the total experience in this case has a novel feel. I imagine a Gump. It is nothing I have ever seen or heard of, and for some strange reason the utterly commonplace group of elements of experience which are at this moment combined into my idea of the object seem to me to yield a highly original result. I do not have any memory of the object. Instead I insist that I am imagining, meaning thereby that I am creating mentally an object which has never before existed in my consciousness and to which I attribute no existence beyond my present consciousness.

The characteristics of imagination.—There is one peculiar fact about imagination. Whereas things feel to us new, they are really made up of elements of experience which are old to us. We do not imagine new sensations or affections, however often we may imagine new objects or events. What we really do is to experience our stock

sensations, affections, perceptions, images, ideas, in new and novel relations. The Gump, after all, possesses only the attributes of objects which I have been familiar with for years, but it possesses these old attributes in new relations. It has the body of a monkey, the horns of a deer, the neck of a giraffe. Truly the experience is new for I never have seen such a creature save with my mind's eye.

Imaginings, as a rule, are novel in the sense that they represent old bits of experience in a new guise and are accompanied by a feeling of newness or originality. Until one learns to take account of the distinguishing marks of memory and imagination, it is impossible to distinguish the old in experience from the new. It is for this reason, and not because of desire to deceive, that the young child falsifies situations. It states as memory facts mere imaginings. It is incapable of telling what it gets by a process of reproductive imagination from what comes as a result of the activity of creative imagination. We are prone to make grave mistakes and to do serious injustice by judging guilty of falsehood those who have neither the intention to deceive nor knowledge of deception.

The importance of memory and imagination.—It would be vain to try to decide which of these varieties of experience or aspects of mental life is the more important. We should be utterly different kinds of beings if we lacked either.

Memory experiences are the keys to many of the secrets of human progress. If we could not relive our mental life we should be unable to profit by experience as we do. Instead of possessing rationality, insight, foresight we should be creatures of the moment, whose consciousness consisted solely of a passing show of elements and complexes of consciousness. This kaleidoscopic series of changes in experience would be varied, ever progressive, never returning upon itself. We should have neither past

nor future, for it is only in memory that we obtain those materials by means of which we are enabled to picture to ourselves a future. It is our supposition that many of the lower animals lack memory wholly, or in large measure, and that their experiences are made up almost if not exclusively of new elements. At the first thought it may seem a desirable condition, that of never having to re-experience anything, but when one comes to the point of thinking out clearly what it would mean he inevitably shrinks from it. To live in the moment alone would be to lack most of our satisfactions, as well as most of our sources of dissatisfaction. It would be to live a non-rational life.

Of unimaginative persons we have plenty about us. In fact it may be said that the majority of us are so. For we are so feeble in creative imagination that we seem rather creatures of memory than of imagination. The contrast between imaginative and unimaginative individuals is sometimes sharp, and although there are persons who doubt the value of imagination, the great majority feel that it is something much to be desired. The unimaginative person is matter-of-fact, commonplace, uninteresting. He lacks originality. He does not progress beyond the beaten track. He is conventional, conservative, dependable. The imaginative person is progressive, unpredictable, interesting. The progress of the world would appear to depend chiefly upon those individuals who are imaginative, whereas the conservation of advances in civilization seemingly depends upon the unimaginative members of the race.

CLASS EXERCISE

Self-observation. The introspection of imaginative (reproductive and creative) consciousnesses. Materials: Sets of advertisements used in previous exercises; note-books.

From memory describe as accurately as you can each of the ten advertisements. Selecting the one which you most distinctly recall, tell as directly and simply as you can how you remember its various features. After completing your detailed memory descriptions compare what you have written with the actual advertisements (your perceptions), in order to discover how much you have reproduced from previous experience and how much you have created in the descriptions.

Did you really remember most accurately the advertisement with which you felt most familiar?

Attempt to imagine an advertisement. Describe your consciousness. How does it differ from your perceptual consciousness of an advertisement? From your memory consciousness?

If time permits, the memory—from the previous exercise—for the ten advertisements may be measured in order that they may be ranked as to memory value. This may crudely be done by having each student write under the number of each advertisement: (1) the exact name of the article advertised; (2) the exact name and address of the manufacturer, or manner of obtaining article; (3) the chief points in the illustration; (4) the chief points in the text of the advertisement.

The values of these results may be estimated by the instructor or by some member of the class, and the set of advertisements arranged in order of accuracy of memory for each individual and for the class as a group. Thus will be obtained values which may be compared with the impression value and the affective value as previously obtained.

A careful comparison of the consciousness of the perceived, the remembered, and the imagined advertisement will prove interesting and profitable in connection with this class exercise.

SUPPLEMENTARY READING

Titchener, E. B.: Text-book of psychology, §§ 112-120.
Calkins, M. W.: Introduction to psychology, chapters 15 and 16.
Thorndike, E. L.: Elements of psychology, chapter 3.
James, Wm.: Principles of psychology, vol. 1, chapter 16; vol. 2, chapter 18.

PART THREE

PSYCHOLOGY AS THE HISTORY OF CONSCIOUSNESS: GENETIC DESCRIPTION

CHAPTER XVII

THE HISTORY OF CONSCIOUSNESS IN THE INDIVIDUAL: ONTOGENESIS

"She was, of course, sometimes quaintly misled in an inference by lack of knowledge. In the last week of the month I shut my eyes and asked her, 'Where are aunty's eyes?' The baby tried in vain to find them behind the lids, and then leaned over from my lap and looked carefully for the lost eyes on the floor!

"I hardly think that memory is much developed at this age [twelve months]; the probability is that even the two-year-old remembers things only in glimpses—one here and one there—but nothing continuous: this is one of the great differences between his mind and ours. But our little girl plainly remembered some things for days. In the second week of the month her uncle showed her how he lifted the window sash, and four days after, catching sight of the finger handle, she tugged at it with impatient cries, trying to make the sash go up. A few days later, having a flower in her hand, when her feet were bare, she began, with a sudden memory, to beg to have something done to her toes with it, and it proved that two or three weeks before her mother had stuck a flower between the fat toes.

"All this month, even more than in the eleventh, she was incessantly busy in exploring and learning. She opened boxes, took things out, and put them back; worked with infinite diligence and seriousness at such matters as getting a rubber ring off a notebook I had stretched it round; investigated crannies, spaces under grates, doors ajar, with an undying curiosity.

"She began to imitate our actions more and more: she tried to comb her hair, to put flowers into a vase, to mark on a paper with a pencil; she pulled at her toes and muttered as if she were saying the piggy rhyme."—SHINN, M. W.: The biography of a baby, pp. 243-245.

The history of mind is called psychogenesis.—The sum of events in consciousness between the birth and the

death of the individual constitutes the history of the mental life of the individual. It is called ontogenesis. Psychogenesis, however, includes the history of mind in the race, as well as in the individual. This is called phylogenesis. Just as it is possible to describe, in the science of embryology, the series of changes which constitutes the history of the development of the body from birth to maturity, so it is possible to describe the development of mind. And just as it is possible to describe, in the science of organic evolution, the development of one type of organism from another, so also it is possible to describe the development of one type of mind from another. As step by step we trace the onward progress of the natural process of evolution from one variety of animal to another, so we are able to trace the progress of mind from one stage to another. Ontogenesis therefore has to do with progressive changes which occur in the mind of some individual. Phylogenesis, instead, has to do with the stages or steps in the evolution of mind which are represented by the various types of living beings.

Nature of the task of ontogenesis.—It is much easier to discover the history of the mind of the individual than that of the race. This is true, first of all because the individual may be observed continuously, if we choose, throughout life, whereas many of the stages through which mind has passed in the evolution of animals are unobservable because they no longer exist upon the earth. Yet, even the accurate and complete history of mind in the individual is difficult to obtain. As a matter of fact no human individual is ever observed continuously. Our genetic description of a person's mental life is always a more or less incomplete patchwork of observations. Nevertheless, we know fairly well the chief characteristics of the mental life of human beings at different stages of their existence and with the facts every student of psychology should be familiar. Psy-

chologically a baby differs as widely from a man or woman as a dog differs from a man.

When does the mental life of the human individual begin?—Waiving the problem of the existence of consciousness before birth—and there are excellent reasons for supposing that it does exist—it may fairly be maintained that for the science of psychology the mental life of each of us begins at birth, for then only do we come within the range of observation. From that moment on, through all the vicissitudes of existence, we continue to furnish material for the student of ontogenesis. It has not as yet been possible for science to determine either the source or the moment of appearance of consciousness in the individual. Fortunately for psychology, this is not an essential matter.

When does the mental life end?—This too is an unsolved problem. All that we can say with certainty is that as psychologists we do not observe consciousness after the death of the individual. We need not insist, need not believe even, that death ends the conscious existence of the person, for it is quite conceivable that consciousness should continue to exist after the body has returned to the dust. Freely the psychologist sets as his limits for the description of the mental life of the individual on the one hand birth and on the other death. Between these great events he attempts to sketch, or to draw in detail, a picture of the stream of consciousness.

Changes in consciousness between birth and death.—Life means constant change. Our bodies are used up in the form of energy and the waste is constantly repaired by nutriment. Every few months the entire body is renewed. Likewise, from the dawn of consciousness there is an ever moving train of mental processes. These it is which make up the flood of the stream of consciousness. To enumerate all of the changes which occur during the mental life of any one of us, or even the chief among them,

would be a herculean task. Instead of attempting it, we may in this chapter merely mention certain of the prominent stages in the mental development of a human being. Partly on physical and partly on psychological grounds, the life of man is commonly divided into a number of periods, each of which is characterized by certain bodily traits and conditions and also by certain mental traits.

The divisions of mental life.—For the purpose of sketching the history of mind in the human individual we may divide life into five periods. They are infancy, childhood, youth, maturity, and age. These, of course, are entirely artificial divisions, for between no two of the periods is there a sharp line. Each gradually passes into the next. As there would undoubtedly be wide difference in opinion as to the years of life included in each of these five periods, it may be well to state precisely their limits as the terms are used in this book. Infancy or babyhood includes the first two years of life; childhood, from the second to the twelfth years; youth, from the twelfth to the twentieth; maturity, from the twentieth to the fiftieth; and age from the fiftieth to death.

The artificiality of this method of splitting up the life of a being is too obvious to need emphasis, but it should be borne in mind that the rate of development mentally and physically varies widely in different individuals. Some of us are as old at five as others are at eight, and even more strikingly obvious is the fact that certain persons are aged long before their time. This indicates that each individual should be studied separately, if we are to discover the facts of his existence or offer a genetic description of his consciousness.

The psychology of infancy or babyhood.—The most important single point in which the consciousness of the infant differs from that of the adult is self-consciousness,

for whereas we adults are keenly conscious of ourselves and constantly distinguishing the self from other selves and from other objects generally, the infant is not conscious of itself. Instead, it is merely aware of happenings. It lives, for the first few months of life, as Professor James has said, in a buzzing, blooming confusion of sensations and feelings. All the while impressions are pouring into the stream of consciousness. The baby at first does not remember for it has nothing to re-live in consciousness, unless, indeed, it be its prenatal existence. It neither thinks nor experiences emotions. The elements of consciousness are at first unrelated fragments: it is only during the early years of childhood that they become knit together in the psychic complexes with which we grown-ups are so familiar.

The infant eagerly seeks new sensations: it tries to touch, handle, taste, smell, and in all other ways of which it is capable, test the qualities of the objects which fall within reach. Once a sensation or a feeling has been experienced, it is possible for it to recur with the marks of memory upon it. Hence, it is quite likely that the baby soon begins to have memories. Then too, its experiences with the world in which it lives soon furnish it the material out of which emotions are formed and it begins to exhibit the signs of anger, resentment, fear, and delight.

Another striking characteristic of infancy is the rapidity with which consciousness changes. The stream of consciousness flows very rapidly at this time of life and it swells apace, for into it are pouring a vast variety of new experiences. Nothing long remains in consciousness. The baby turns rapidly from object to object, attending for only a few seconds to each. Again and again it returns to the same object. Restlessness, impatience, efforts to repeat experiences constantly appear. Attention is readily obtained, but with difficulty held.

Like the animal, the infant lacks systematic means of expressing itself. It has gestures and bodily expressions, similar to those which later come to indicate to us feelings or emotions, but it is incapable of speech. True, during the latter part of the second year of life it may acquire a number of sounds which it uses to indicate objects of peculiar significance to it, as, for example, its mother or nurse, its bottle or toys. For precisely this reason the study of the psychology of the infant is similar in method to animal psychology. In both instances it is necessary to depend upon direct observation of what the individual does and thus to read the mental life of the being instead of making use of introspection. Indeed, the human being is several years old before introspective ability has developed to a useful degree.

The consciousness of the baby during the first few months is made up of sensations and feelings. These come to it not all at once but in a certain order. At birth the infant is sensitive to light. It clearly experiences sensations of the achromatic series, but in all probability not so many qualities as do we. During the first year or more of life it does not experience color sensations. It lives, therefore, in a world of lights and shadows and movements. It is not until sometime in the second year that color qualities begin to be experienced. They come gradually, it would seem, and it is years before this series is present in its completeness. In other words, it takes a long time to acquire the full quota of visual sensations.

Most infants appear to be deaf at birth, and it is often a day, or even two or three, before tone or noise sensations are experienced. We have no very satisfactory knowledge of the nature and variety of the early auditory sensations, but there are reasons for suspecting that the infant only very slowly comes into the experience of the series of tone sensations with which psychologists are familiar. At first

doubtless all sounds seem much alike, just as to the adult all the new faces of a foreign race look alike.

Taste and smell sensations are received soon after birth, but there are no indications of a variety of qualities and we must suppose that the consciousness of the baby only gradually comes to include a considerable number of these elements.

Touch sensation seems to be present from the first.

To sum up the discussion of sensation—the infant rapidly grows into its life of sensation. Before the end of the second year of life there is reason to believe that it is familiar with a large number of the fifty or more thousand of sense qualities which the psychologist describes. But at the same time it lacks introspective ability. " And even when an ordinary excitation does penetrate to the slumberous little consciousness, the utmost response which it awakes (to quote Professor James) is best ' expressed by the bare interjection " lo "!'—except, indeed, in the case of pains or sharp discomforts which doubtless make a more intense and voluminous, though probably no more distinct, impression. The story is told of a young mother who brought in her bachelor brother to see the new baby asleep in its cradle. Among the other things she asked if he didn't think the baby was very intelligent. He said he didn't feel himself altogether a competent judge and asked what the baby did that was so intelligent. The mother exclaimed, ' Why, you great stupid, don't you see how intelligently he breathes! ' The mother didn't miss by far the baby's highest pitch of intelligence." (Sanford, E. C.: Mental Growth and Decay, *Amer. Jour. of Psy.*, vol. 13, p. 429).

The psychology of childhood.—Between the second year and the twelfth the process of mental development proceeds with astonishing rapidity. The child learns to distinguish itself from other objects. It learns to talk, and

its language provides us with ample proof of its ability to think. To the multitudes of sense qualities, feelings, memory images, and simple ideas which were present at the close of infancy are now added with increasing speed ideas and associations. It is a memorable day in the life of the parent when the first baby puts two ideas together so that they represent a thought. And from that point to the formulating of thoughts in sentences is not far.

The child, unlike the infant, is more or less fully conscious of itself and tends rapidly to become increasingly so. It not only feels, its knows that it feels. That is, it is capable of self-observation. It not only has sensations of color: it knows that it does and is able to express the fact verbally. Language comes as the result of the presence of ideas, but at the same time it offers a great incentive to thought, for the child is constantly seeking for something to express.

Clear evidences of reasoning sometimes appear toward the close of infancy, but it is during the psychological changes of childhood that the human being so rapidly and far outstrips the animal. The child of two years exhibits an emotional life which is highly complex and its intellectual life is evidently incomparably more complex than that of the infant. It acquires associations, learns new things about its environment and itself day by day, and long before the twelfth year has been passed it is living a mental life which is in its chief essentials like that of the adult.

Childhood can be studied psychologically a little more satisfactorily than infancy because the child has greater powers of movement and a considerable command of language, as well as some ability in self-observation. Indeed, after the fifth year, it is possible to get the child so to describe its experiences that the psychologist may directly enter into the fruits of its labors.

The greatest difference between child and adult men-

tally lies in the store of experience. Whereas the child has few and not highly varied experiences, the adult has lived through a far greater variety. The same holds of emotional and other affective experiences as of intellectual experiences, for the longer one has lived the larger the stock is likely to be.

There is a novelty and freshness about experience for the child which the adult lacks. There are new experiences, and many of them, for the infant; fewer, but still a great variety, for the child; but for the adult most experiences are old. They can be re-lived, but they lack the novelty and vividness which give its chief characteristic to the consciousness of the child.

Childhood is a period of immense intellectual vigor. The process of learning or of acquiring experiences and fitting them together progresses with tremendous rapidity. Therefore it is that this is the time for educational training.

One of the important differences between the child's mind and the adult's is in the manner of perceiving things. We not only learn to distinguish sensations: we also learn to see things. The child does not perceive the world as does the adult and therefore arise many misunderstandings for which parents and teachers are responsible. A touching illustration of failure to bridge this gap is offered by Professor Judd.

"I remember when I was a little boy riding across a high railroad bridge with my father. Down on the flat land at the river level were some laborers. I was much interested in them, they were such little men. I could have held one of them in my hand. I decided to share my delight with my father, and induced him to look out and see my pygmies. Like all children, I believed, of course, in the infallibility of my father and of my own eyes. My beliefs received something of a shock that day when he

told me that my pygmies were just ordinary men, and turned back to his reading. I dare say I charitably attributed his remark to the rather superficial glance he had given the men; at any rate, I remember believing in the testimony of my eyes in that case, and silently protesting against what was, from my point of view, a most unaccountable lack of interest in a curious race of men. Need I add the explanation of this experience? A little greater elevation, a little less experience in the interpretation of visual sizes, and man and boy might have had experiences more alike. As it was, those men were inside the range of my father's interpretation of perspective, while they were outside of mine.

"Years after I was a party to a similar comparison of adult and child experience; this time, however, I was the adult. We were riding along together, and looking out over the broad pasture land, a little girl of six and I, when we saw some horses grazing quietly a quarter of a mile or so away. There was no difficulty in recognizing the horses as animals of full, ordinary size. And I was surprised into looking a second and even a third time by the little girl's cries of joy at seeing "those colts," as she insisted on calling them. Finally, I realized that the horses were to her untrained eyes colts. I even induced her to discuss the matter with me until I told her that they were really horses, and then the look of incredulous pity for my grown-up ignorance gave me one of the best insights I have ever had into the truth of the principle that children and adults live in different worlds. I also had a clearer understanding of the child's mind at that moment from my understanding of the fact that if the quarter of a mile had grown into two miles, I, too, might have been in doubt as to whether the horses were horses or colts." (Judd, C. H.: Genetic Psychology, pp. 9-10.)

The child is highly imaginative instead of matter of

fact. Experience does not enable it to distinguish with certainty between the products of reproductive imagination (memory) and creative imagination (imagination). Because of this confusion it can not tell the truth as do adults. The child lives often in a purely imaginary world: playing with imaginary toys or companions, eating purely imaginary food, and drinking imaginary tea or coffee. Indeed, of childhood nothing is so sharply and distinctively characteristic, no one feature of mental life serves as well to distinguish it from adulthood, as imaginativeness. The child lives happily in a world of its own creation: the adult lives in a world of brutal facts. The contrast is one which we would not destroy. Rather in aiding the individual to pass from the childish stage of mental development to the adult stage, we should seek to retain imaginativeness while rationalizing it through contact with the matter-of-fact world.

The memory of the child, as a rule, is admirable. Recognition, at first doubtful in the infant, is clearly exhibited and the part which memory experiences play in the mental life is obvious.

Adults too frequently make the mistake of underestimating the intelligence and insight of the child. The infant seems to us more intelligent than it really is, just as do many animals (because they act reasonably), but the child often seems less intelligent than it is and we are led into grave mistakes of treatment.

The psychology of youth.—Peculiarly distinctive of this period of mental development is the sudden transition from childish interests to the interests and ideals of the grown-up. Between the ages of twelve and twenty, we rapidly pass from imaginativeness to practicality. Our sensations and feelings are well developed; we distinguish sense qualities as well as ever; we note contrasts of feelings. Our emotional life is in the ascendant, for there rush into conscious-

ness a multitude of new relations and interests which mark the transition from childhood to manhood or womanhood. These tend to interfere somewhat with the steady progress of mental development. The purely intellectual life is, for a time, subordinated to the affective life. The youth is a creature of sentiments, emotions, feelings, ideals, dreams, as contrasted, on the one hand, with the imaginative child and, on the other, with the prosaic man.

In fact, it would seem that such mental progress as occurs during youth is largely brought about by the influence of the emotions and sentiments. Affective, as contrasted with logical, judgments predominate and determine the nature of the rational life. The youth is rash as compared with the child or the adult; he is a creature of strong and action-impelling desires and emotions. He knows the world in much the way, although less well, that the adult does, but for him it has a much stronger feeling value. This it is which the practical experiences of contact with the world in later life tone down.

"It is a time of hero-worship also—sometimes real people, sometimes imaginary ones. It is the time for day dreaming, for air castles, for romance, for ideal literature in poetry and prose. The day dreams and ideals are sometimes impossible; they are often crude; they are always inexperienced; but they are not therefore fair targets for ridicule. The boy of sixteen may be doing a deal more of serious thinking than he gets credit for. He realizes his inexperience and the crudity of his thought, and he is eager enough for something better, but he hates to have what he has taken pleasure in laughed at (or even smiled over), and so does not talk of it. As he advances in age his ideals become more definite and tangible; he gets down toward reality, and in the end experience furnishes all the correction necessary. Perhaps too much! At this early age he is ready to put his ideals into practice; he may not be

later. It is the youth, who, when duty whispers low, ' Thou must,' replies, ' I can.' '' (Sanford, E. C.: *American Journal of Psychology*, vol. 13, p. 442.)

If infancy is the most appealing period of mental and physical development because of the individual's helplessness, and childhood the most fascinating because of its imaginativeness, youth is the most engaging because of its enthusiasms, high hopes, sentiments, and ideals.

The psychology of maturity.—Mental development, in the sense of increase in intellectual power, usually continues for a considerable period after the twentieth year. Some persons continue to increase in mental power throughout a long life. But the most noteworthy feature of the mature mind is, not its sense qualities and feelings, for the youth has these in like form, but its abundance of ideas and associations, its reasoning processes and its ability to initiate and sustain new lines of thought.

The infant lives a life of sense impressions and simple feelings.

The child lives a life of perceptions, ideas, memories, and associations.

The youth lives a life of ideas and emotions.

The adult lives a life of thought and feeling. Which predominates depends upon the constitution of the individual.

Between the twentieth and the fiftieth years of life the power to see in the sense of perceiving reaches its maximum; the power to acquire new facts, to form new associations, rapidly wanes. It is at its maximum during the early years of life. For this reason, memorizing is easier during childhood than later in life.

The adult, in the full bloom of his intellectual and affective capacities, seeks new combinations of experiences, creates new objects, lives in a world of intellectual or emotional endeavor.

Because of the lack of novelty in experience, time seems to pass quickly. This is in marked contrast with the experience of the child. Every adult thinks with puzzled curiosity of the length of the years of childhood and the shortness of the years of manhood. The older we become, the shorter seems the year or month or day.

Maturity is a period of variable length between youth and age. The limit of twenty to fifty years is too short for some individuals, too long for others. But all those who live to die of old age or of the infirmities thereof, experience a marked change, or set of changes, in mental life. These changes are as interesting as are the changes of childhood, albeit not so cheering.

The psychology of age or senility.—Life may be likened to a mountain with rapidly sloping sides. Infancy is the first stage of the upward slope on one side; childhood carries us nearer to the summit; youth bears us almost to the crest; maturity carries us to the crest, holds us there for a longer or shorter space of time, and then gradually allows us to descend the opposite side. With age, we reach the lower slopes, corresponding to those occupied by infancy and childhood. There is sad truth in the saying that in old age we tend to become childish. Some even become infantile. Sometimes at forty, sometimes not before sixty or even seventy, body and mind begin to fail in strength. Little by little the variety of sensations and feelings decreases; sight, hearing, and the other special senses either become dull or are lost; the emotions and sentiments become less vivid than they were in maturity; associations are more slowly acquired; memory weakens, especially for recent experiences; thought is slow and ineffective. Interest in life wanes and the individual sinks gradually into a psychological state which, although superficially resembling that of the child, as a matter of fact differs radically from it. The aged person is childish only

in that the mental powers are on the level of the child's.

In the early years of life the memory for recent events is best; in senility the memory for remote (early) experiences is best.

Mental growth and degeneration are exhibited in every individual who lives out his three score years and ten, and the complete history of the span from the dawn of consciousness to its disappearance from view is a long and fascinating story. In this chapter we have only sketched its chief changes. The whole story would fill a volume. Scientifically and practically the psychological characteristics of the various periods of life are of great importance and interest, for it is only in the light of thorough knowledge thereof that we can understand our fellow men.

CLASS EXERCISE

Self-observation. The perception of time. Materials: stop watch; record blanks; note-books; a book of general interest from which the instructor may read.

The instructor should choose three, or, if time permits, four different conditions for the estimation of intervals. In the illustrative record-sheet appended four conditions, which are designated as "idleness," "reading," "writing," and "estimating," were used. The class should be instructed that each of the several intervals—four may be used, varying in length from a quarter of a minute to a minute and a half or two minutes—is to be judged in seconds, and the result recorded in the record blank at the end of the interval. It should further be explained that the condition of "idleness" demands simple passivity, without special attention to the task of judging the length of the interval; that during "reading" attention is to be given undividedly to the passage read aloud by the instructor; that during "writing" attention is similarly to be given to writing from the dictation of the instructor; that during "estimating" attention is to be concentrated upon the task of judging the length of the interval. Each individual should choose the method of doing this—other

than counting heart-beats, clock-ticks, etc.—which promises to give him most accurate results.

It is well to begin this exercise by giving a thirty-second interval as a standard. Members of the class should of course be ignorant of the actual lengths of the intervals used in the exercise.

In the accompanying record-blank, the lengths of the intervals used in a number of experiments by the author are given. These are needlessly long.

TIME ESTIMATION

A RECORD-BLANK FOR JUDGMENTS OF THE LENGTH OF INTERVALS OF TIME

Name Place
Age Date

Order of Tests	Actual Length in Seconds
1. Idleness	108
2. Reading	36
3. Writing	72
4. Estimating	18
5. Reading	108
6. Idleness	36
7. Writing	18
8. Estimating	108
9. Reading	72
10. Idleness	72
11. Writing	36
12. Estimating	72
13. Reading	18
14. Writing	108
15. Estimating	36
16. Idleness	18

Questions concerning the perception of time and its changes during ontogenesis. Recall your last vacation. Does the interval seem, in memory, longer or shorter than a corresponding interval during the school year? Which seemed the longer in passing? Why? Do the days, months, or years seem as long now as formerly? If not, how do you account for the change?

The record-blanks for the class, after they have been properly filled out by the members of the class, may be delivered to a student with instructions to make a thorough statistical study of the results and report to the class. In the preparation of this

report a paper on "Time estimation," by R. M. Yerkes and F. M. Urban in the *Harvard Psychological Studies,* vol. 2, pp. 405-430, and a briefer description of a similar exercise by R. MacDougall, which appeared in *Science,* N. S., vol. 19, pp. 708-709, may prove of service.

SUPPLEMENTARY READING

Preyer, Wm.: Mental development in the child.
Shinn, M. W.: The biography of a baby.
Sanford, E. C.: Mental growth and decay. *American Journal of Psychology,* vol. 13, pp. 426-449.
Calkins, M. W.: Introduction to psychology, chapter 26.

CHAPTER XVIII

THE HISTORY OF CONSCIOUSNESS IN THE RACE: PHYLOGENESIS

"One of my chicks three or four days old snapped up a hive-bee and ran off with it. Then he dropped it, shook his head much and often, and wiped his bill repeatedly. I do not think he had been stung, probably he tasted the poison. In any case, in a few minutes he seemed quite happy and eager after new experiences. But though he came and looked at it once or twice, he made no further attempt to run off with the hive-bee. An association, based on a single experience, was at least temporarily established. Similar experiments with the unpleasant caterpillar of the cinnabar moth and with lady-birds showed that the association between a peculiar appearance and nasty taste was in all cases very rapidly established, and that the visual impression suggested the idea or re-presentation of unpleasant gustatory experience."—MORGAN, C. LLOYD: Introduction to comparative psychology, second edition, p. 86.

The natural process of evolution.—Everything has a history. Sometimes this history is a record of changes in a definite direction, or, as we are in the habit of saying, toward a certain goal. Sometimes it is merely a record of slight and irregular variations in position, size, shape, energy, or relation to other things. Evolution is an orderly series of changes which may be described, as in the case of the formation of the earth, the development of plants and animals, or the growth of an object of human creation. A house evolves in the mind of the architect and under the hands of artisans; a painting evolves, under the intelligent and artistic touch of the painter, just as truly as any natural object evolves from one stage or condition of existence to another. Worlds to-day are believed to be evolving by two series of changes: the one progressive, the other regressive. The story of the world in which we live, as

told in the history of the earth by geologists, is an account of the evolution of our home. It is similar in principle to the story of the development of one type of animal or of plant from another form. To-day this series of changes, leading from one variety or species of animal or plant to another more or less markedly different, may be observed as we observe the growth of the animal from infancy to age. There is nothing fanciful in the belief that man has evolved from animals. Accepting, as we do, the account of man's body as offered in the general theory of evolution, we are forced to inquire what is the story or history of the human mind.

There has been, and still continues, an evolution of mind.—In the human individual one may at any time observe the unfolding of mind, the development of mental life from its simple beginnings in the baby to its complex and manifold condition in the adult man. Similarly, although not so directly nor so easily, we may observe the evolution of mind in the race. Centuries ago there existed on the earth man-like animals whose consciousness was different in important respects from ours. Their bodies, too, were unlike ours. By a series of changes both mind and body became what is now called human. This is a step in the evolution of mankind. The mind of man differs no more strikingly from that of the dog or the monkey than does his body. It is as easy to conceive of the processes by which one became transformed into the other in the case of mind as in the case of body. We may not see the changes, but we must believe they occurred, if we are to hold to the evolution theory. From the mind of the simple-celled microscopic organism to that of the ant is a long stretch, but may it not have been bridged by innumerable slight changes? And so from the mind of the amœba to that of man, it is conceivable that, could one see the changes as they really occurred, there should be nothing more

startling in the sight than in the growth of a house from a pile of bricks and boards.

Types of mind and the breaks in the process of evolution.—At present it is quite impossible to trace the history of the body of man back through the animal races to its earliest ancestor, for many of the steps in the series of changes have utterly disappeared from the earth. For precisely the same reason, it is impossible to follow the history of mind in the race back through the ages, and from one type of living thing to another. As we examine the varieties of mind which are now to be found on our earth, we note vast differences in character, and the relations of one variety to another are sometimes obscure. So numerous and so large are the gaps in the series of changes from the mind of the amœba to that of man that no one can with certainty place all existing minds in the series. The probability is that many of them do not belong there.

The recapitulation theory.—From the observations of embryologists there arose the idea that the individual organism more or less perfectly repeats the series of changes which has occurred in the race. Or, in other words, that in developing from simple cell to adult organism the human being passes successively through the various stages or conditions of the race which together constitute the evolutionary series. If one of the remote ancestors of man was a variety of fish, then at some time in development each one of us passes through a fish stage! Observation has fully proved that we do not pass through these stages in detail; they seem to be greatly condensed and abbreviated, so that a million years of racial, or as it is called, phylogenetic, evolution, may be passed through by the individual in a few hours. Incomplete and fleeting as it is, this tendency for the individual to repeat the history of the race has considerable value for the student of the history of the body and mind of man. For in studying

the consciousness of human beings we constantly observe phenomena which remind us of the minds of other animals. In man we see more or less clearly not only each human ancestor, but also, with rapidly diminishing clearness, his animal ancestors. But the recapitulation theory must not be overtaxed. It may be that our preconceived ideas of the stages through which the organism passed in progressing from amœba to man have led us to imagine that we see these stages mirrored in the developing individual.

The mental life of animals.—The study of the minds of animals is much like that of the mind of the infant and the young child for they can not introspect for us expertly as can many adults. Nevertheless, animal psychology today is in excellent condition. Indeed, it is fair to contend that we know as much about the mental life of many types of animals as we do about the infant's consciousness.

It is no more necessary to inquire whether a given animal has a mind than it is to ask the same question concerning the human infant. We have every reason to believe that many animals have minds and it would be as absurd to deny this statement as to contend that the human infant is not conscious because it can not introspect or is not self-conscious. Animals have minds and it is the business of the psychologist to study their characteristics to the best of his ability. Only thus can we hope to discover even a portion of the racial history of mind.

There are many types of mind, just as there are many types of body.—Upon the earth at present there exist thousands of differing species of animals. Each of these species or types of living creature probably has a variety of mind which is characteristic of it. When one states that animals are conscious, he does not necessarily mean that they are conscious as is man. He may, instead, mean that they are conscious as is the infant, or even in a more simple and primitive manner. The task of studying the animal mind is

therefore one of discovering the psychological characteristics of each type of organism. But it may not stop there, for just as in the case of human beings we discover that there are great and all-important individual differences which make it highly desirable to study individuals instead of the type, so in animals, the individual differences or peculiarities of mind are so marked that one may not describe the mind of a particular animal in any detail from knowledge of the characteristics of the mind of the species to which it belongs. Nevertheless, there is a type of mind characteristic of the cat—the acme of selfishness—of the dog, of the orang-outang, just as there is of man. It is these types which must be described and related to one another—as the steps in the development of the body from germ to adult must be related to one another—if the racial history of mind is ever to be completely written.

Plants as well as animals may have minds.—There is no valid reason for denying the existence of mind in plants. On the contrary, there is abundant reason for the opposite opinion, for especially the sensitive plants, Mimosa, Dionæa (Venus' fly trap), Drosera, and Drosophyllum, in so many respects behave as do animals that one can but treat them as conscious. The writer is content, in his investigations of the consciousness of organisms, to grant that mind may be coextensive with life and to study every living thing from the point of view of psychology.

The classification of animals.—Zoölogists have classified animals according to their resemblances in bodily form. Psychologists have made no classification according to resemblances in mental life. Yet, such a classification is both possible and desirable. For the purposes of this book it is not necessary that we attempt an elaborate psychological classification, although it would be convenient for our use were one at hand. Instead, in the description of types of animal mind which is to constitute our sketch of

the history of the development of mind in the race, we shall use a crude combination of zoölogical and psychological classifications. The animal kingdom will be divided into six groups as follows:

Group I. Animals which lack a nervous system: the unicellular organisms.

II. Multicellular organisms which, although possessing a nervous system, are simple in structure and behavior as compared with all other animals except those of the first group.

III. Insects: animals with complicated structure and behavior, but lacking a back-bone.

IV. The lower vertebrate animals: fishes, amphibians, reptiles, and birds.

V. The higher vertebrates, including all of the mammalia, except the primates.

VI. The primates: monkeys and apes, excepting man.

In the remainder of this chapter an attempt will be made to sketch the psychological characteristics of these six large groups of animals. The descriptions must necessarily be incomplete and perhaps to a certain extent misleading, because of lack of space for details.

The psychology of simple one-celled organisms, Group I.—Familiar examples of this group are amœba, paramecium, stentor, vorticella, and the bacteria. In form these creatures are distinguished from all other animals by single-celled bodies and the lack of brain, sense organs, and nerves. They are simply constructed and simple in their behavior. What of their mental life?

The best authority on the mental life of an animal is not necessarily he who talks or speculates most about its possibility, probability, or nature, but instead he who is most intimately acquainted with the structure of the animal

and with its activities. No one in America is more competent to express an opinion concerning the presence of mind in unicellular organisms than is Professor H. S. Jennings. His conclusion is expressed in the following words:

"Is the behavior of lower organisms of the character which we should 'naturally' expect and appreciate if they did have conscious states, of undifferentiated character, and acted under similar conscious states in a parallel way to man?

"If one thinks this question through for such an organism as Paramecium, with all its limitations of sensitiveness and movement, it appears to the writer that an affirmative answer must be given. . . . Suppose that this animal were conscious to such an extent as its limitations seem to permit. Suppose that it could feel a certain degree of pain when injured; that it received certain sensations from alkali, others from acids, others from solid bodies, etc.,—would it not be natural for it to act as it does? That is, can we not, through our consciousness, *appreciate* its drawing away from things that hurt it, its trial of the environment when the conditions are bad, its attempting to move forward in various directions, till it finds one where the conditions are not bad, and the like? To the writer it seems that we can; that Paramecium in this behavior makes such an impression that one involuntarily recognizes it as a little subject acting in ways analogous to our own. Still stronger, perhaps, is this impression when observing an amœba obtaining food. . . . The writer is thoroughly convinced, after long study of the behavior of this organism, that if amœba were a large animal, so as to come within the everyday experience of human beings, its behavior would at once call forth the attribution to it of states of pleasure and pain, of hunger, desire, and the like, on precisely the same basis as one attributes these

things to the dog." (Jennings, H. S.: Behavior of the Lower Organisms, p. 336.)

In the opinion of the authorities who have given this matter most careful consideration the mind of the one-celled animals consists of a certain limited number of sense qualities, together with feelings of agreeableness and disagreeableness. These sense qualities are not necessarily the same in all the animals of the group; on the contrary, there probably are considerable variations. There is no sufficient reason for assuming that the animals experience ideas, memories, emotions, sentiments, thoughts, or any of the psychic complexes which have been observed in man. Their mental lives are extremely, delightfully, simple as compared with ours. Theirs must be lives of simple awareness of certain features of their surroundings, without even the consciousness of self as distinguished from environment. There is absolutely no reason for supposing that they are self-conscious. In a word, the organisms of this, our first group, are psychologically below the level of the infant newly born.

The psychology of simple multicellular animals of Group II.—In this group are found the sea-anemones, jelly-fishes, hydras, crabs, worms, etc. They are made up of many cells; they have more or less complicated nervous systems, and their behavior is, perhaps, more complex than that of the representatives of Group I.

Here sensations exist in a much greater variety of mode and quality than is the case in the mind of the one-celled animals. Feelings exist too, and apparently in more complex forms than in simpler organisms. Certain evidences of images, lacking, perhaps, the element of recognition or the feeling of familiarity, are discoverable, and we must conclude that the minds of these creatures resemble that of the infant at birth more closely than do those of simpler creatures. Many varieties of worms, crustaceans,

and coelenterates are known to profit by experience in ways which strongly suggest consciousness of the re-presentative sort. But we must not be over-generous in our ascription of mental states to them.

The psychology of the insects, Group III.—As a whole the insects appear to be more highly and more complexly conscious than the animals of Groups I and II. Their bodies are highly organized and, especially with respect to their nervous systems, they approach the degree of differentiation found in man. Undoubtedly, however, certain insects are lower both physically and psychologically than are exceptional representatives of Group II.

Sense modes appear to be more numerous in the insects than in unicellular animals or in the representatives of Group II. Ants, bees, wasps, and other social insects evidently experience a great variety of sense qualities. Their perceptions are far more complex than those met with in Groups I and II. There are evidences that their feelings also are vivid and varied. The affective side of their experience consists predominantly of instinct consciousness. This fact, coupled with the observation that a large number of their environmental relations are definite and almost automatically met in action, has led to the impression that they lack complex experiences and are mere creatures of instinct. It is high time that biology and psychology took account of the fact that instinct as a form of action has as its accompaniment an important affective variety of consciousness.

" It is evident that the best way to know what instincts are is to experience, that is, to live them. Such experience shows that they arise as primitive volitions or cravings, or what the Germans call " Triebe "—a word for which we have no exact equivalent in the English language—and that they are inseparable from certain pleasurable or painful emotions. The question then suggests itself as to

whether there is anything to indicate that ants experience similar internal states. We are, of course, working here merely with analogical inferences and probabilities, and may, therefore, incur the contempt of a whole school of German physiologists, but, as has been often stated by other authors, we must either proceed in this manner or abandon animal psychology altogether. I admit that it is very easy and very reprehensible to read one's own psychology into an animal, but after a patient, and, I believe, unprejudiced study of the ants, I have reached the same conclusions as Forel, Wasmann, and others, namely, that these insects show unequivocal signs of possessing both feelings and impulses. In my opinion they experience both anger and fear, both affection and aversion, elation and depression in a simple, " blind " form, that is, without anything like the complex psychical accompaniment which these emotions arouse in us. Whether a stinging ant or hornet merely exhibits a pure reflex or has a feeling of anger besides, is a nice problem. I have unintentionally sat on nests of *Vespa germanica* and *Pogonomyrmex barbatus*, and while I have no doubt that I myself acted reflexly under the circumstances, it will take quite an army of physiologists to convince me that these creatures were acting as nothing but reflex machines." (Wheeler, W. M.: Ants: Their Structure, Development, and Behavior, p. 529.)

Viewed in the light of their highly organized social relations and adaptations many of the insects seem more intelligent, more nearly human in their rationality, perhaps, than are the majority of the vertebrates. It is only their small size and lack of close resemblance to ourselves that enables us to think of them as unconscious mechanisms. Were ants large enough to be obtrusive, and were they also similar to us in general bodily form, we should undoubtedly consider their behavior indicative of an intel-

ligence similar to our own. The chief difference would appear in the relative importance of instinct and reason.

It is difficult to place the animals of this group in their relation to the history of consciousness in the race. They seem to lie off the direct line of progress and they may well be considered a divergent group. To compare them directly in their mental life with the human being is even more difficult, for in some respects they are more remarkable than the two-year-old child, while in others they are hopelessly inferior. With reason, one might claim that certain of the insects are psychologically superior to man and represent a stage in the evolution of mind which, although strikingly different, is more advanced than our own. And, on the other hand, it must be admitted that the direction in which our mental life has developed is not to be conceived of as a stage in the evolution of insect consciousness. Rather we may conclude that the social insects represent the highest development of mind in one direction; and man, the highest development, in another direction. It is not for us, with modesty, to insist that our psychic characteristics are best!

The psychology of the lower vertebrate animals, Group IV.—The fishes, frogs, salamanders, and toads are far less interesting psychologically than many of the insects. They possess many modes of sense and a fair degree of discriminative ability, but of complex relational experiences: emotions, sentiments, associations, memories, they apparently have few or none. If the mind of man is to be conceived of as having evolved from that of a frog or a fish, a vast gap must be bridged, for there is a world of difference in mental make up.

The reptiles and birds have a wider range of experiences and, in some instances, they appear to live a life of emotions and memories. Many of them appear to be on the level of the higher insects, although markedly dif-

ferent from them in respect to complexity of instinctive behavior. Rationality of a sort may be attributed to some of them. It is different from ours, doubtless, in that there is less clear and inclusive awareness of the conditions and results of action. Between the most intelligent representatives of this large group of vertebrates and man there is a gap which ages of development might have bridged.

The psychology of the higher vertebrates, Group V.— With this group we reach those animals to which we feel mentally most nearly akin. For in the horse, the dog, the raccoon, the squirrel, and other of the mammals we discover experiences like our own. This is not simply because many of these animals are our hearth-side companions and patient servants. Even in the creatures of the wild we detect many similar mental traits. For all of the animals of this group, save those toward which we have some special cause for enmity, we have a degree of sympathy and interest which far surpasses that which we feel for the other animals about us. Therefore it is that we object to the abuse or mutilation of a dog, although we may quite calmly eat a live oyster or plunge a living lobster into hot water.

There is no question, in the mind of the person who really knows animals, that the higher vertebrates possess a great variety of sense qualities and feelings. Doubtless these differ in many respects from ours, and even among one another, but on the whole they appear to be more nearly like ours than those in any other group of living things. Of emotions, sentiments, associations, memory images, ideas, and even certain forms of judgment there are noteworthy evidences, and the more liberal among psychologists are at present inclined to believe that at least some animals, among them the dog and horse, the raccoon and cat, experience conscious complexes which are much like ours. It is upon this subject that the attention of animal psychologists, who are interested in what animals

feel rather than merely in what they do, is now concentrated.

The dog and the cat may be compared in the characteristics of their mental life to the infant of from birth to a year of age. Perhaps at times they transcend this limit and enter into the range of experiences of the next three or four months of human life, but this would appear to be exceptional. Could the student of the animal mind for one brief hour introspect the consciousness of a dog there can be no doubt that the science of psychology would be revolutionized.

The psychology of the primates, Group VI.—To be sure the primates are higher vertebrates and also mammals, but by their closer resemblance structurally to us, as well as by their mental traits, they are entitled to be placed in a separate class. It is not alone in bodily form that they are strikingly like us. They share a large portion of those psychological peculiarities which distinguish us from animals. The monkeys and the apes are man-like in their curiosity, their emotional life, their ideas, their memories.

Between the other vertebrates and the highest apes there is a great psychological gulf. It is almost as difficult for the imagination to bridge it as it is to imagine the transition from the mental life of the fishes to that of the birds.

If the consciousness of the dog may fairly be compared with that of the infant during the first year of life, that of the orang-outang and of the chimpanzee may be compared with that of the first three years of human life. The child, during the third year of life, exhibits practically all of the characteristic psychological traits of the human being, and in a similar way the ape exhibits these traits throughout its life. But the child matures, enters into a wider and ever widening range of experiences, whereas the ape seems to stand still. What the child has in germ,

and the man in fully developed form, the ape always possesses in germ.

For the intimate and thorough student of the animal mind it is by no means difficult to think of the mind of the monkey or the ape as a step in the evolution of the human mind. The difference in mental life is a matter of degree, not of kind. Few traits which man possesses seem wholly lacking in the other primates.

The tree of mental evolution.—An effective way to represent to one's self an outline of the history of animals is the racial tree. Thus we may, with the aid of the available facts of bodily structure and their relations, construct a tree of the evolution of one type of animal from another. It schematically represents the steps in evolution. In similar fashion we may picture to ourselves the course of mental evolution by means of a tree.

At the base of the tree, as the starting point of mind, we have the animals of Group I. Theirs is the primitive kind of consciousness, a mere awareness of something. This point in the evolution of mind might appropriately be called the dawn of consciousness. Doubtless plants should not be excluded from this scheme, for their consciousness probably evolved simultaneously with that of animals. However, for them we should have to construct a different sort of tree whose only connection with that for animals would be at the base.

Proceeding upward along the trunk of our tree, we might represent the condition of mental life found in Group II at a distance above the base. At this point mind has evolved into a vastly more complex and varied awareness, including several qualities of sensation and feeling, if not memories also.

Here the tree forks and we are no longer able to follow a direct line from group to group. One main branch leads us finally, as its crowning glory, to the mind of the higher

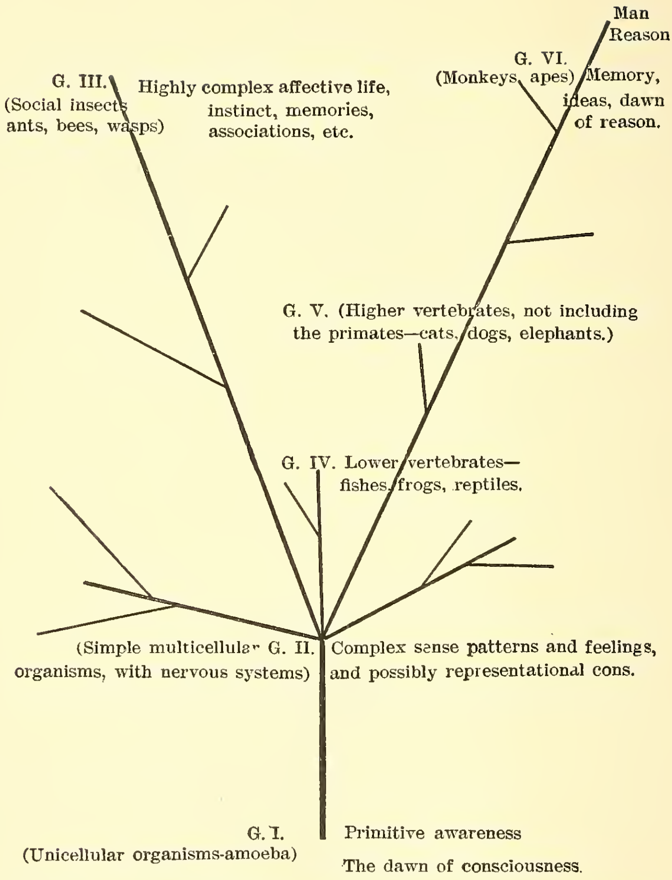

Fig. 5. The psycho-phylogenetic tree. G. I (Group I), unicellular organisms: primitive awareness; G. II, simple multicellular organisms: sense qualities and patterns, feelings, and, possibly, representational consciousness; G. III, social insects: sense and affective patterns, associations and images; G. IV, lower vertebrates: sense patterns, associations and images—affective consciousness less developed than in social insects; G. V, higher vertebrates, exclusive of the primates: complex perceptual and emotional life, images; G. VI, monkeys and apes: memory and ideas, dawn of reason.

social insects, Group III. This product of the natural process of development is as far removed from the starting point in Group I as is the mind of man. The two most noteworthy achievements of mental evolution—the mind of man and of the social insects—are almost if not quite as distant from one another as is the mind of the ant from that of the worm. Between the mental life represented in Group II and that of Group III many important stages have intervened, and it is more than likely that certain of them are still existent. Only a thorough study of the mental life of animals now existent can enable us to decide this matter.

Following another of the main branches of the tree we come next to the stage of Group IV, the lower vertebrates. Their type of mind represents a direction of mental evolution which is radically different from that of the insects and which is therefore indicated in our tree by placing the two on different branches. Further along on this branch we find Group V, Group VI, and finally the stage of human consciousness.

Of the two remaining branches which emerge from the trunk of our tree at Group II nothing can certainly be said. We suppose that many directions of mental evolution must have proved useless and disappeared from the earth, as have many tendencies in bodily evolution. The same is true of the subdivisions of the main branches. They are meant to indicate the fact that mental evolution has proceeded, and is proceeding, for all that we know to the contrary, in a great number of directions.

Thus crudely we may present to ourselves a picture of the course of the evolution of mind from its earliest manifestations to its condition in man. The particular tree which I have constructed in the light of my limited knowledge may prove to be incorrect, but however that may be, it will serve to make clear our chief lesson in the study

of the history of mind in the race, namely, that mind has changed step by step, in one direction or another, until finally there has appeared upon the earth in connection with other and widely differing types of mental life the consciousness of man.

CLASS EXERCISE

Observation of animal mind. The grading of animals in intelligence. Materials: a list of twenty animals with which all the members of the class are familiar; record sheet.

Each member of the class should, after a brief discussion of the purpose and method of the exercise by the instructor, arrange the names in the list in the order of diminishing intelligence: i.e., from the animal which, in the opinion of the student, furnishes most abundant and satisfactory evidences of complex mental life to that which furnishes least satisfactory evidences of intelligence.

In connection with the task, it is likely to prove important to have each individual formulate a definition of "intelligence," and to state briefly but clearly the chief reasons for the particular ranking of the animals.

A proposed list of animals. This will not prove equally satisfactory in different parts of the country. House-fly, mosquito, dog, rabbit, rat, toad, ant, honey-bee, cat, monkey, pigeon, squirrel, canary, crow, sparrow, mouse, pike, tortoise, jelly-fish, horse.

The record sheets may be taken for examination by some member of the class and the results tabulated and studied, as in the case of the results of the exercises with advertisements. The average order should be determined, and the departures of individuals from this average.

SUPPLEMENTARY READING

Morgan, C. Lloyd: Introduction to comparative psychology.
Washburn, M. F.: The animal mind, chapters 1, 2, 3, 10, 11, 12.
Yerkes, R. M.: The dancing mouse, chapters 6, 7, 8, 9, 10, 11, 12.
Kirkpatrick, E. A.: Genetic psychology, chapter 5.
Thorndike, E. L.: Animal intelligence.

PART FOUR

PSYCHOLOGY AS GENERALIZATION

CHAPTER XIX

OBSERVATIONS, GENERALIZATIONS, LAWS, AND PRINCIPLES

"The immediate contents of experience which constitute the subject-matter of psychology, are in all cases processes of a composite character. Sense perceptions, memories of such sense perceptions, feelings, emotions, and volitional acts, are not only continually united in the most various ways, but each of these processes is itself a more or less composite whole. The idea of an external body, for example, is made up of partial ideas of its parts. A tone may be ever so simple, but we localize it in some direction, thus bringing it into connection with the idea of external space, which is highly composite. Every feeling is referred to some sensation that aroused the feeling, and every volition is referred to an object willed. In dealing with a complex fact of this kind, scientific investigation has *three* problems to be solved in succession. The *first* is the *analysis* of composite processes; the *second* is the *demonstration of the combinations* into which the elements discovered by analysis enter; the *third* is the *investigation of the laws* that are operative in the formation of such combinations."—WUNDT, WM.: Outlines of psychology, p. 28.

Differences between observation and generalization.— We always observe a particular occurrence. It is the fact that a particular stone falls to the ground when I let go of it that I observe. When from repeated observation of this kind of behavior on the part of the stone, and of many other like objects, I reach the conclusion that all stones will fall to the ground if thrown into the air, I have formulated a scientific generalization, for it is something which I can never observe. No matter how many experiments I may try, there will always be other stones or other objects with

which I have no direct contact and whose behavior I have not tested. We are able to see or otherwise directly take knowledge of the particular fact, but the generalization is a product of the scientific imagination. Those observers who lack this quality of mind can do nothing but observe particular facts and describe them, thus laying the foundation for the brilliant generalizations of observers who possess imagination.

In chemistry the qualities and even the atoms of gold are observed and described, but the generalization, from these particular facts, that all substances are composed of atoms is beyond observation. Likewise, in biology, the observation that a certain cat has a tail and the verification of this observation on animal after animal, finally leads to the thought that a tail is the property of all cats. But further observation may reveal exceptions, as in the case of the Manx cat, to this generalization.

Certain general statements are known as laws.—Any generalization which enables us to predict the properties of an object may be called a law. The laws of chemical combination are condensed statements of what may be expected wherever two substances enter into combination. The laws of gravitation likewise, in a few words, tell us what we may expect of objects under certain definite conditions. The laws of habit-formation, were they definitely known, would similarly enable us to predict the behavior of an animal under known conditions. It is to be noted that these so-called laws are merely the application of particular observations to a variety of situations like the one or ones in which the observation was made. Having noted with my own eyes the fact that two chemical substances always combine with one another in definite proportions, I venture upon the statement that this is a law of their combination. And having further observed the same fact in the case of other substances, I further conclude that the statement has

a still wider applicability, and forthwith I formulate the law of definite proportions.

Chemistry has three laws which enable it to predict the behavior of substances with respect to one another. They are:

Dalton's first law: The law of definite proportions. The relative weights of elementary substances in a compound are definite and invariable.

Dalton's second law: The law of multiple proportions. When two elements unite with each other to form more than one compound, the resulting compounds contain simple multiple proportions of one element as compared with a constant quantity of the other.

Wenzel, Richter, Dalton: The law of reciprocal proportions. The ponderable quantities in which substances unite with the same substances express the relation, or a simple multiple thereof, in which they unite with each other.

Professor Pearson's definition of scientific law.—The English biologist, Professor Karl Pearson, has defined a law as " a formula which in a few words resumes a wide range of facts. The object served by the discovery of such laws is the economy of thought.

" The law of gravitation is a brief description of *how* every particle of matter in the universe is altering its motion with reference to every other particle. It does not tell us *why* particles thus move; it does not tell us *why* the earth describes a certain curve round the sun. It simply resumes, in a few brief words, the relationships observed between a vast range of phenomena. It economizes thought by stating in conceptual shorthand that routine of our perceptions which forms for us the universe of gravitating matter." (Pearson, K.: Grammar of Science, second edition, pp. 77, 78, 99.)

The law of gravitation in its most general form is thus

formulated: "Every two bodies or portions of matter in the universe attract each other with a force proportional directly to the quantity of matter they contain, and inversely proportional to the square of their distances."

Laws differ with respect to the number of facts to which they apply.—Some laws enable us to predict the behavior of a large number of objects—this is true of the three chemical laws just formulated—others apply only to a narrowly limited variety of object, as, for example, to the human being, the chair, or the stone. A law of habit-formation which has been demonstrated to hold for the frog is applicable perhaps to millions of objects, for there are many objects of this class in the world, but how much greater would be its range of application should it be demonstrated by observation to hold for all animals. Thus we see that the range or inclusiveness of these generalizations to which the name law is applied varies greatly.

Another type of general statement is called a principle.—The scientific principle, apart from the usage of this term as synonymous with law, which is common, is a generalization which must prove true if our definition of our object is to remain correct. Every science has its fundamental and its subordinate principles the modification of which occurs only upon the discovery of some serious error of generalization. Whereas the law is something which observation indicates to be true, and yet which may at any moment be proved to be narrowly limited in its application, the principle is a generalization which must be true under the conditions of observation. This is the usage of the word principle advocated by the eminent mathematical physicist, Professor Poincaré. He writes, "When a law has received sufficient confirmation from experiment, we may adopt either of two attitudes: either we may leave this law in the fray; it will then remain subjected to an incessant revision, which without any doubt will end by

demonstrating that it is only approximative. Or else we may elevate it into a principle by adopting conventions such that the proposition may be certainly true." (Poincaré, H.: The Value of Science, p. 124.)

Definitions of fact, law, and principle.—A fact is a simple product of observation. It is the raw material of science. A law is a generalization which is made possible by the accumulation and examination of facts in comparison with one another. A principle is a generalization which according to definition of the objects of observation must be true. It can not be overthrown by observation, whereas the law may be. Facts are the first fruits of scientific research; they are also the last, for this kind of material is inexhaustible. But the crowning glory of every science is its generalizations.

Description and generalization naturally proceed side by side.—The separation of description and generalization in this book is highly artificial and unnatural. We observe the particular fact and immediately describe it. Again we observe the same kind of fact and describe it. This continues without ceasing. But from time to time our particular observations are grouped into smaller or larger collections for which a single description is formulated. Thus description becomes generalization. It might fairly be argued that generalization is merely one kind of description. This indeed is the conception of the writer. Nevertheless, it has seemed best in this book to discuss generalization separately even at the risk of giving the impression that scientific laws are radically different from other descriptions.

The law, as truly as the particular statement of fact, is descriptive, for it tells us something about the things which we observe or may observe. The chief gain in separating description and generalization in psychology at this time is the emphasis of the importance of the latter form of

description. Psychology has its facts, it has also its general statements, its laws, and its principles.

Generalization is common to sciences.—All sciences have their general statements, but some either because of greater abundance of facts or of highly imaginative investigators have many more than others. Generalization can not profitably outrun observation. We must have the particular fact before we can formulate the law descriptive of it.

Psychology and its facts.—To present adequately the facts of any highly developed science is a gigantic task. They are so numerous and so varied that they demand unnumbered words. Thus far this book has been devoted chiefly to a general account of the kinds of facts with which psychology deals. This account has been brief and necessarily incomplete. Now we shall turn to the laws of mental life to which the facts of observation have led investigators.

It is rather because of the youth of the science as science than because of the character of its materials that psychology has not accumulated a larger body of generalizations and that the text-books do not more frequently contain the word law.

Examples of physical and psychological facts.—The distinction between facts and generalizations seems clear enough as one reads of it, but when one attempts, while reading a scientific book, to classify the statements as particular facts, laws, and principles, difficulties are likely to arise. Perhaps we may avoid some of them by examining a few more instances of facts and generalizations in various fields of scientific observation.

I toss a stone into the water and it sinks; I throw a bit of wood in and it does not sink. These are physical facts which I have observed. The greater part of the time of the infant is spent in accumulating just such bits of in-

formation about objects. One never gets all the information that one might have. Some people retain throughout life the curiosity which impels them to constant search for new facts about things. They are information mad. Others, with the maturing of their mental powers and the blunting of their interest in the world of facts by the wearing off of novelty, become more interested in generalizations and laws than in particular facts.

Or, I touch a sensitive plant, a bird, or a child with a hot object and each draws away; similarly I touch a bar of iron or a log and see no movement. These are physiological facts, a particular kind of physical fact perhaps.

Again, I observe that each time I experience a particular sensation of sound certain peculiar sensations of shiver follow in its train; that whenever I become aware of a vivid color sensation there follows some other variety of sense quality.

The stone is a physical object concerning which many brute facts are known. It has weight, hardness, friability, structure, temperature, and it enters into certain observable relations with other objects of observation.

The same is true of the sensitive plant, or the bird or child. Pages might be filled with the description of any one of the objects of these classes and these descriptions would consist of an enumeration of particular facts of observation.

Precisely the same holds of the sensations of sound, of shiver, of color. For we know in the light of our study of descriptive psychology that the description of an object of consciousness involves the enumeration of all the facts which we have been able to discover concerning it. Thus the sound sensation is described by statements concerning its quality, intensity, duration, extension, clearness, affective accompaniments and other relations.

Examples of physical and psychological generalizations.—Most of the statements which one reads in scientific books are general statements based upon the accumulated observations of the science. Were this not the case the beginning student would be insufferably bored by details. To be sure, it is quite possible to teach science through the presentation of particular facts, but it is not always practicable.

In a text-book of physics we read the following: "If you take a piece of sealing-wax or of resin, or a glass rod, and rub it upon a piece of flannel or silk, it will be found to have acquired a property which it did not previously possess: namely, the power of attracting to itself such light bodies as chaff, or dust, or bits of paper." (Thompson, S.: Elementary Lessons in Electricity and Magnetism, p. 3.) This at first seems like a set of particular statements, but consideration of the meaning of the whole soon convinces the reader that a number of generalizations are implied. First, it would be quite hazardous for any writer to state that any one of the three kinds of objects would behave thus unless many observations had been made. Therefore there is implied the general statement that any bit of sealing-wax if rubbed with flannel will attract chaff. The same generalization holds of resin and of glass rods. Further, there are the generalizations that all pieces of flannel and of silk will produce the same effect on sealing-wax, resin, and glass rods. Thus the apparently simple physical statement turns out to rest upon a number of simple generalizations.

In a psychological text (Angell's "Psychology," p. 234) we read "When memory begins to decay under the advance of age there is a remarkable uniformity in the order in which certain kinds of knowledge disappear, . . . Thus, the memory of proper names is among the earliest of the losses, and the more concrete are our ideas, the earlier do

we lose the memory of the words for them." These are general statements, for they are based not on a particular observation but on a number of observations in which a certain uniformity has been noted. The particular form of the first statement would be that John Doe in his old age lost first his power to recall proper names, etc. It would be highly unscientific to state upon the basis of this single observation that the same holds true for all human beings whose memory disintegrates.

Books are full of generalizations.—The really thoroughgoing scientist never loses his tendency to question a generalization. Indeed, he may always feel certain that further study, as Poincare points out, will lead to some modification of the generalization. We never know all of the facts and therefore our laws can not be complete or wholly true.

There is nothing much more illuminating in this connection than to go over a few paragraphs of some scientific book carefully and critically in order to pick out the particular statements and the general statements, the laws and the principles. If it be done with this book, it will doubtless be found to consist chiefly of statements which must be classed as generalizations. The text-book writer, to save space and the time of his readers, must take grave responsibilities in formulating generalizations. Often he would greatly prefer to offer the particular facts.

An imaginary psychological law.—Let us suppose that an observer notices the fact that as his finger touches a toothed wheel which is just beginning to revolve he experiences separate sensations of touch or pressure similar in quality and intensity and that he notes also an increase in the rate or frequency of these sensations as the speed of the wheel is increased. Thirdly, he observes that after a certain speed has been attained the sensations are no longer separate and distinguishable but instead run together or fuse into a continuous contact sensation. It feels

as though the wheel were smooth instead of toothed. Let us suppose that this series of simple psychological observations causes the observer to remember also that when flashes of light come very frequently they yield, instead of separate sensations of light, a continuous sensation; that when clicks or other noises follow one another with a frequency greater than twenty to thirty a second, they are heard as a continuous sound instead of as separate noises. And let us further suppose that these facts set him wondering as to what general description will so accurately describe these and similar facts of the fusion of sensations that, given the conditions of observation, one might predict when fusion will occur.

Our scientist might first of all imagine that the following law would hold. When the stimuli are presented at a rate which is higher than that demanded for the covering of the life span of the sensation fusion occurs. Supposing that a certain quality and intensity of tactual sensation requires one-thousandth of a second to develop and wane, then the presentation of tactual stimuli more frequently than a thousand per second would result in the experience of a continuous pressure. And supposing that the total duration of a particular quality and intensity of auditory sensation is one twenty-fifth of a second, then the presentation of clicks, for example, at this rate or higher would result in a continuous sound. The same would hold of all modes of sense. This, we say, is possibly a valid law. It would remain for the observer who in imagination had formulated such a law, to proceed to test it by the rigorous observation of facts. Finding that it did not at all fit the facts, he would of course have to turn to another formula. As a rule the result of such a procedure as we are imagining is that the formulation proves to be neither wholly right nor wrong, but instead needs to be corrected or modified in accordance with the facts. This the ob-

server does and thereupon presents to science a more or less exact and reliable generalization.

Laws may be formulated either prior to observation or on the basis thereof.—All investigators of insight and energy are constantly formulating statements which they imagine to describe correctly a group of facts. They then, if they are honest workers, set about making the observations which shall prove or disprove the validity of the formulæ. This method is perfectly proper and very valuable in practice. There are many scientists, however, who never discover a law unless they have the observed facts before them as an aid to their imaginations.

CLASS EXERCISE

Self-observation. The facts of color mixture and generalizations (laws) therefrom. Materials: a color mixer (simple electrical mixers may be obtained); discs of red, yellow, green, blue, black, and white papers cut to fit the mixer and slit along a radius.

With the members of the class so placed that each can see clearly the colored disc, the instructor should make a series of experiments to demonstrate some of the laws of color mixture.

1. Combine in equal proportions (a) red and white, (b) yellow and white, (c) green and white, (d) blue and white. In each case the student should record his observation concerning the results of the mixture (introspective description). Summarize all of the particular observations in a general statement, generalization, or law of color mixture.

2. Combine similarly in equal proportions each color, in turn, with black. Describe the results and formulate a generalization.

3. Combine each color in equal proportions with each of the others: thus, red with yellow, with green, with blue; yellow with green, with blue; green with blue. Describe the results of the mixtures and formulate a general statement which shall present the essential characteristics in the several results.

SUPPLEMENTARY READING

Poincaré, H.: The value of science; also Science and hypothesis.
Pearson, K.: Grammar of science, chapter 3.
Baldwin, J. M.: Dictionary of philosophy and psychology, "Law."

CHAPTER XX

LAWS OF SENSATION AND PERCEPTION

"In our normal waking life every conscious process, of whatever grade, may be said to be supported by sensory stimuli; that is, our consciousness accompanies central nervous processes that depend upon the current stimulation of sense organs. . . . The most absorbed meditation is affected by the sensory stimuli that we are receiving. This is shown by our well-known preference for certain places, surroundings, or objects, as aids to our meditations. One carries on a meditation of a given type best in his study, or again best in church, or again by preference during a walk in the fields. At such times one may not be at all directly conscious of how one's inner process is related to the sensory stimuli. Thus, in the fields, one may suppose that one is entirely oblivious of the natural facts about one, just because one is absorbed in some train of thought that bears on a scientific topic, or on a personal and practical problem. But none the less, the external objects are all the time sending in their sensory disturbances. These maintain certain current conditions of the brain. Were these conditions to change, the train of thought would change. And even where the connection between surrounding objects and the train of thought pursued is by no means one of which we are definitely conscious, the just mentioned preference for one sort of surrounding as against another, as the place for a given kind of meditation, illustrates how important this relation may be."—ROYCE, JOSIAH: Outlines of psychology, pp. 123, 124.

Typical laws of sensibility.—Since it is quite impossible, within the compass of a brief text-book, to enumerate all of the generalizations of the science, only a few typical or representative laws will be presented. From these it is hoped the student may gain a clear notion of the meaning of generalization as well as of the character of the laws of mental life. The laws mentioned are not necessarily the most important, nor are they those which are best established by observation, for *in some instances the writer has purposely chosen to cite generalizations which evidently*

demand further verification before they may be safely accepted. The reader will inevitably notice that the statements which in this portion of the book are set forth as generalizations or laws are in all respects like many of the statements of the earlier parts of the book, and in so doing he will have observed correctly, for it is true that this part of the book is intended simply as a special examination of the laws of psychology.

The generalizations of psychology are not always strictly psychological.—There are many so-called psychological generalizations which express certain observed uniformities or correlations between physical and mental events. These should be called psycho-physical laws or generalizations. No attempt has been made in this book to exclude generalizations which are not strictly psychological, but wherever such a statement is made attention has been called to its partial psychological nature. This will enable the student to avoid confusion of the two points of view and to learn how to distinguish the physical from the psychical. Doubtless the psycho-physical laws are quite as important as the psychological and as deserving of our attention.

The laws of sensation may be arranged with respect to the properties of sensation.—As will become apparent in the course of this chapter, there are certain generalizations which refer particularly to the quality of sensation, others to intensity, others to duration, others to extensity, and still others to clearness and to affective accompaniments. Although the procedure is highly artificial and in some respects apt to prove misleading to the thoughtless or casual reader, it has seemed desirable to arrange the laws of this chapter under the general headings of the properties of sensation. We shall therefore consider in turn the laws, or rather some of the laws, of each of the common properties of sensation.

GENERALIZATIONS CONCERNING THE QUALITY OF SENSATIONS

From the earlier chapters on sensation many generalizations may be selected which would seem worthy of the name laws.—It is, for example, a law that every sensation possesses quality, intensity, etc. Additional laws concern the way in which the particular or individual properties of a sensation vary with variation in the common properties. There is almost unlimited opportunity for research in this field and it would be idle to attempt to formulate the laws here. Oddly enough we know much more about the laws of the relations of sensations than about their peculiarities in isolation. This is due doubtless to the fact that in experience they exist as a rule only in intimate relation to one another.

Law of the qualitative relation of sensations.—When two sensations appear in consciousness at the same time or in quick succession they may enter into any one of several relations to one another. This is commonly expressed by the statement that sensations combine in different ways. There are four important varieties of combination:

(1) Simple combination
(2) Partial fusion
(3) Complete fusion
(4) Inhibition

These four possibilities may be stated thus simply. The two sensations may exist side by side without modifying one another with respect to quality. They may partly fuse or run together, so that although neither is quite itself both can be identified by introspection as parts of the combination. They may fuse completely so that neither is identifiable, and this fusing may result in a sensation whose quality is entirely different from that of either of the original sensations. The one may destroy the other, or

they may mutually destroy one another so that nothing remains.

In each of the modes of sense, and from mode to mode, we discover illustrations of these varieties of relation. We may examine a few of the special laws expressive thereof.

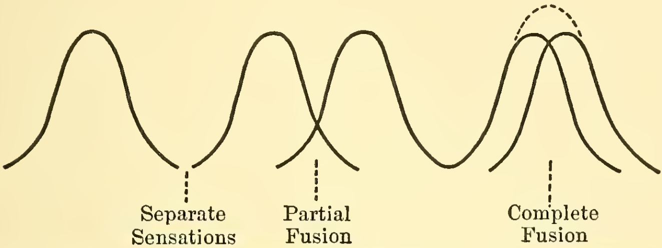

FIG. 6. Representing the isolation, partial, and complete fusion of sensations.

Laws of the relations of visual sensations.—(1) Law of relation of color to light sensations. Every color sensation is accompanied by a light sensation. Illustration: As the intensity of a green sensation is diminished, a point is finally reached at which the color experience disappears while the sensation of light continues to exist.

(2) Law of complementary colors. For every color sensation there exists another which if combined with it in the proper proportions will result in a sensation of colorless light. Illustrations: Red and green, properly combined, yield the experience of gray. The same is true of yellow and blue. This evidently is a case of complete fusion.

(3) Law of partial color fusion. When two colors which are not complementaries are combined a new color quality is experienced. This new quality stands between the original colors in the spectral series and its position with respect to them is determined by their relative intensities and degrees of saturation. Illustration: When a green sensation is combined with a blue the quality known as

greenish-blue or blue-green may result. It is possible by combining two or more color qualities to match any color sensation which we experience.

(4) Every visual sensation affects other simultaneously occurring visual sensations according to the laws of contrast. Illustration: A black spot looks blacker because of the simultaneous appearance of a white spot.

(5) The contrast effect produced by two visual sensations is always in the direction of greatest qualitative opposition. Illustration: White and black being extreme opposites, a white background always increases the apparent blackness of a dark object upon it. Red and green being opposites (antagonists or complementaries), a green background always causes objects upon it to appear reddish, and a red background likewise causes objects to appear greenish.

(6) The more saturated the inducing color (the background or predominating color), the greater the contrast effect. Illustration: The more saturated the green background the redder appears the object upon it.

(7) The nearer together the contrasting surfaces, the greater the contrast effect. Illustration: When the black spot lies directly upon the white background it appears blacker than it does when it is raised above the white surface.

(8) Color contrast is at its maximum when contrast of light is absent. Illustration: If upon a green background a patch of gray paper of the same lightness as the green be placed, the gray will appear more markedly reddish (the contrast color induced by green) than it would if the green and the gray differed in lightness.

(9) Contrast effects are increased by the hiding of contours. Illustration: The more clearly defined the outlines of an object upon a background the less the color or light contrast effect. It is for this reason that in demonstrating contrast effects of color, a sheet of tissue paper is usually

placed over the object and its background so that the outlines are obscured.

These are fair samples of the many laws of visual sensation which might, if space permitted, be presented at this time.

Laws of the relations of olfactory sensations.—The laws according to which odors combine with one another are very imperfectly known as compared with those of vision and they are mentioned merely in order to give the student a true estimate of the progress which psychology has made in the task of generalizing. If vision alone were mentioned his estimate would be exaggerated. If smell alone were mentioned, it would be too small.

(1) Odors combine in each of the four ways mentioned at the beginning of this discussion: by simple combination, by partial fusion, by complete fusion, and by inhibition.

(2) Law of partial fusion. For every odor sensation there are others which when combined with it in certain intensities give rise to a sensation in which both of the original components are distinguishable. Illustration: Iodine and camphor thus mix after the manner of partial fusion, and so do camphor and laudanum.

(3) Law of complete fusion. For every odor sensation there appears to be another or others which when combined with it in the proper proportions gives rise to a new quality of sensation in which neither of the original odors is detectable. Such odors may appropriately be termed complementaries or antagonists, for like the complementary colors they destroy one another and give origin to a new quality of sensation. Illustration: The odors of cedarwood and India rubber, or of beeswax and India rubber, under certain conditions antagonize one another.

(4) Law of olfactory contrast. When simultaneously or successively presented, an odor sensation modifies by con-

trast the quality of certain other sensations. The laws of odor contrast effects are too imperfectly known to justify an attempt at formulation.

GENERALIZATIONS CONCERNING THE INTENSITY OF SENSATIONS

Law of the range of intensity.—Every quality ranges between two extremes. The minimal intensity is called the threshold sensation, and the maximal intensity is called the maximal sensation. Illustration: Beginning with a light sensation which is just perceivable, it is possible to pass by steps to an intensity of light which can not be exceeded. Likewise in the case of an odor or a sound, below a certain limit the stimulus has no corresponding sensation, and above a certain limit there is no observable increase in the intensity of the sensation.

Law of the just perceivable difference in sensations.—For every sensation (except the threshold and the maximal), of whatever mode, there is a sensation intensity which is just perceivably less and one which is just perceivably greater. Whether these two steps, the one downward in the scale of intensity and the other upward, are equal is an important problem for psychology to solve. If they can be proved to be so, a simple method of measuring the value of a sensation in terms of units of intensity will have been discovered. Illustration: Given a certain sensation of light which is midway between the threshold and the maximum, there is another intensity of the same quality which can be said to be just weaker than the first and another which can similarly be said to be just stronger.

The Weber-Fechner law of the relation of stimulus to intensity of sensation.—In order that a stimulus shall be rendered just noticeably stronger it must be increased by a certain constant fraction of itself. For example, a weight of one ounce upon the hand feels lighter than one of one

and a tenth ounces, whereas all the variations between an ounce and one and a tenth feel the same as one ounce. Similarly a weight of ten ounces feels just noticeably lighter than one weighing eleven ounces. The stimulus must, in the case of passive touch or pressure, be increased or diminished by one-tenth of itself in order that it shall seem different.

This is obviously a psycho-physical law, for it expresses a uniformity of relation observed to exist between stimulus and sensation.

Law of summation of sensations.—Under certain conditions two sensations of the same quality appearing in consciousness either together or successively sum up and yield an intensity which is greater than that of either alone. Illustration: With repetition a sensation of cold which is at first agreeable becomes painfully intense. Two touch sensations from adjacent points on the skin may fuse into one which is more intense than either.

Law of inhibition.—Again, under certain conditions, a sensation may either partially or completely destroy another's intensity without noticeably altering the quality or qualities. Illustration: A sensation of color may diminish the intensity of a simultaneously occurring sensation of cutaneous pain.

Law of adaptation.—If a stimulus be long continued or often repeated in a brief interval, its accompanying sensation tends to diminish in intensity and change in quality. Illustration: If the hand be plunged into a pitcher of water which is almost unbearably hot the sensation of temperature will be very intense. If thence it be transferred to a vessel of warm water, it may seem even cool. The skin rapidly becomes adapted, the psychologist tells us, to the condition of stimulation. Under a constant condition of stimulation, the intensity, clearness, and quality of a sensation is likely to change gradually or suddenly. It is adaptation which

exhibits itself when in a room filled with a vile odor we rapidly become accustomed to it. The sensation loses intensity and becomes almost unrecognizable. As we become adapted to a colored light the intensity and quality of the sensation change.

Adaptation appears in all of the senses. It is a provision against the perseverance in consciousness of a given sensation. According to this law there may be rapid change even when conditions of stimulation are fairly constant. In smell and taste adaptation is quite as evident as in touch and temperature and vision. It is closely related to fatigue and exhaustion as is proved by the fact that we may become adapted, fatigued, or exhausted for one odor and still smell others strongly.

GENERALIZATIONS CONCERNING THE DURATION OF SENSATIONS

Law of latent period.—For each mode of sensation there is a specific interval termed the latent period, during which the sensation matures or develops from its minimal to its greatest intensity. Illustration: Pain sensations are said to arise or develop much less rapidly than do touch sensations. This is readily observable in the case of the human skin.

Law of the relation of latent period to strength of stimulus.—It appears that the duration of the latent period is inversely proportional to the intensity of the stimulus. The stronger the stimulus, within limits, the sooner the sensation reaches its greatest intensity.

This generalization demands further verification.

Law of after-images.—Under certain conditions, a sensation is uniformly followed by an after sensation which bears a definite qualitative and intensive relation to the original sensation. After-images occur strikingly in vision, hearing, touch, temperature, pain, and some other sense modes. There are two kinds of visual after-images: the

positive and the negative. The positive after-image closely resembles the original sensation in quality and intensity; the negative presents the conditions of light reversed as in a photographic negative. Illustration: To observe a positive after-image look steadily at a gas flame for a few seconds, then turn it off quickly. The flame and burner may for an instant be seen as a positive after-image. To observe negative after-images gaze out of a bright window steadily for a few seconds and then suddenly turn the gaze upon a uniformly and not too brightly illuminated wall. The window will appear as an after-image with its light parts dark and its dark parts light.

Professor Titchener thus formulates the laws of negative after-images:

(1) The color or brightness of the images is always antagonistic to the color or brightness of the stimulus (original sensation). Illustration: A red spot is followed by an after-image of green.

(2) A contrast color in the stimulus is effective in the after-image. Illustration: Suppose that a gray patch upon a red background has been viewed, then the negative after-image should show the spot as reddish instead of as greenish as it appeared in contrast and the background as green.

(3) The interaction and reciprocal influence of differently stimulated parts of the retina persist in the after-image.

(4) The after-image is intermittent or periodic, not continuous.

(5) The intensity and duration of the after-image are a function of the intensity (relative and absolute) and duration of the stimulus, and of the intensity of the reacting light.

It would be easy to multiply generalizations regarding after-images in the various modes of sense. They are

important features of the mental life of all of us and in some instances they become strikingly interesting on account of their variety and frequency.

The after-images of touch, pressure, and pain are fairly easy to observe. The distinct after-throbs of touch, cold, warmth, and pain should be observed by every one. The study of after-images constitutes an easy and interesting approach to psychology, and it furnishes splendid opportunities for practice in self-observation.

GENERALIZATIONS CONCERNING THE EXTENSITY OF SENSATIONS

The law of extensity of tone.—It would appear that the extensity of a tone is inversely proportional to its pitch. Illustration: As we proceed from low tones to high tones, we note a diminution in the voluminousness of the sounds. This law demands further observation.

Law of the localization of sensations.—Every sensation is referred more or less definitely to a particular portion of the body, or to an external object. Every cutaneous sensation, for example, has as one of its particular properties, a local sign by which it is distinguishable from other touch sensations.

Law of accuracy of localization and fineness of discrimination.—The more frequently a given sensation has been experienced with its appropriate local sign the more accurately it can be located by the observer and the more definitely it can be distinguished from sensations arising from surrounding parts of the skin.

GENERALIZATIONS CONCERNING THE CLEARNESS OF SENSATIONS

Law of the relation of clearness to sensation.—Clearness is an essential attribute of sensation. It varies in degree, as does intensity, but it is never lacking.

Law of the relation of clearness to intensity.—Other conditions remaining constant, the more intense a sensation the clearer it is likely to be. Clearness, however, depends upon other factors than stimulus strength, which is the prime condition of intensity, and it is frequently noted that a weak sensation is clear, whereas a strong one is unclear.

Law of the relation of clearness to introspection.—The harder one tries to observe a sensation the clearer it tends to become.

Law of the relation of clearness to quality.—New, novel, or unusual qualities of sensation tend to be clearer than those with which we are perfectly familiar.

Law of the relation of clearness to affective tone.—The stronger the affective accompaniment of a sensation the clearer it is likely to be.

Law of the relation of clearness to attention.—That which is clear is attended. To attend to a sensation means simply to experience it clearly. Were we able to state accurately the several factors which determine the clearness of a sensation we should be able also to describe those conditions which favor attention. In other words, the laws of clearness are in part identical with the laws of attention.

The importance of clearness.—The memory value of a sensation seems to depend largely, if not chiefly, upon its degree of clearness. That which we do not clearly experience we do not readily or accurately recall for introspective examination. It would seem, therefore, that those conditions of consciousness which favor sensory clearness are favorable also to the subsequent recall of experiences.

GENERALIZATIONS CONCERNING THE AFFECTIVE ACCOMPANIMENTS OF SENSATIONS

Law of the relation of affections to sensations.—Every sensation is accompanied by an affection (sense-feeling,

as Professor Wundt calls it). This statement is not generally accepted by psychologists, and it should be carefully tested by observation.

Law of relation of affection to intensity of sensation.—Change in the intensity of sensation from the threshold to the maximum is usually accompanied by a two-fold change in the sense-feelings: a change in intensity and a change in quality from agreeable to disagreeable. There are instances in which the change in quality does not occur, but it is the usual thing.

As a sensation of sweet or of warmth is steadily increased from the threshold intensity, it "feels" first pleasant with gradually increasing intensity, but beyond a certain point, without change in the quality of the sensation, the affection becomes unpleasant.

Law of the relation of affective sense accompaniments to bodily condition.—Sensations which accompany bodily processes which are favorable to the life of the individual usually possess pleasant affections; those which accompany bodily processes which are unfavorable usually possess unpleasant affections.

A LIST OF THE FUNDAMENTAL LAWS OF SENSIBILITY

As a summary and review of the chapter there is offered below a list of the chief generalizations concerning sensory consciousness.

1. *Law of threshold.*—For every quality of sensation there is a minimal or threshold intensity at which the quality is just recognizable. This is commonly called the threshold sensation.

2. *Law of maximal sensation.*—For every quality of sensation there is an intensity beyond which the quality of the sensation no longer remains constant, even if it continues to exist. This is the maximal sensation.

3. *Law of just perceivable difference in sensations.*—The sensations of a given quality may be arranged in series in such wise that each differs from the next by precisely that amount which is necessary in order that they be introspectively distinguishable.

4. *Law of adaptation.*—Even with the stimulus for a sensation remaining constant, it tends upon repeated appearance in consciousness to change in both quality and intensity.

5. *Law of exhaustion.*—Under definitely describable conditions a sensation ceases to reappear in consciousness after a certain number of repetitions.

6. *Law of contrast.*—When two sensations of different quality, or of different intensity, either simultaneously or successively appear in consciousness they tend mutually to modify one another according to certain laws, the most important of which is that each tends to render the other the opposite of itself.

7. *Law of mixture.*—Under certain conditions, when two sensations appear in consciousness either together or successively they run together so that each loses its identity and a third sensation appears in which each of the originals is recognizable.

8. *Law of fusion.*—Under certain conditions, two sensations completely fuse so that they are themselves lost and give rise to an entirely new sense quality.

9. *Law of inhibition.*—Under certain conditions, when two sensations together compete for introspective presentation, the one completely destroys the other, or each has an inhibitory effect upon the other.

10. *Law of latent period.*—Every sensation during a certain interval waxes in intensity.

11. *Law of life-span.*—Every sensation has a definite period of life. It rises to its maximum intensity and then wanes. This period with its three parts—waxing,

crest, and waning—may best be represented by a curve. (Fig. 6, p. 259.)

12. *Law of summation.*—Under certain conditions, if a sensation be repeated frequently, the repetitions sum up so that a sensation of greater intensity results.

13. *Law of positive after-image.*—A sensation may be followed in consciousness by a more or less dim repetition of itself, a sort of shadow sensation, which is known as its positive after-image.

14. *Law of negative after-image.*—Under certain conditions, a sensation is uniformly followed by a sensation of the opposite quality, intensity, or both.

15. *Law of local sign.*—Every sensation possesses definite relations to other sensations which are known as its local signature.

Each of these classes of laws has many special formulations and for each sense mode there are special laws. Each law leads beyond itself by suggesting other generalizations which are demanded if the law is to be rendered of its highest service to man as a means of predicting events.

PERCEPTION

Sensations carry meaning.—As they exist in concrete experiences sensations are so related to one another, to affections, to images, and to ideas that they become the bearers of meaning. We speak, therefore, not of our sensations of space or of objects, but of our perceptions. The laws of perception might appropriately be considered under the general topic sensibility were it not for the fact that affections and images are as important constituents of many perceptions as are sensations.

GENERALIZATIONS CONCERNING PERCEPTION

Law of perception.—Simultaneously presented sensations, affections, and images tend to become welded into an apparently single unitary consciousness. Illustration: I am experiencing the sensations of light, color, cold, pressure, odor, and taste from an apple, together with a certain agreeableness which accompanies the flavor, a certain dis-

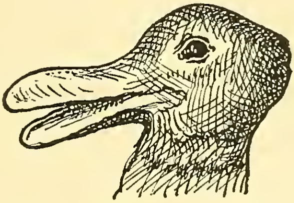

FIG. 7. Double perception.

agreeableness which accompanies the coolness, and images of more or less similar sensations, and possibly also of feelings, which have previously been experienced. But all of these elements of my consciousness are so closely related that only persistent attempts at analysis enable me to tease them out of the perception. I simply am conscious of the apple. I do more than " sense it," more than " feel " thus and so toward it, more than imagine it, for my perception is made up of sensations, affections, and images.

Law of least resistance.—We tend strongly to group mental elements and so to supplement them by images as to get perceptions which we have previously experienced. Less technically stated, *we are likely to see things as we have seen them.* Illustration: Fig. 7 may be perceived in at least two ways, which one of the two objects one sees depends upon the point of fixation. If one at first perceives a duck's head the chances are that it will dominate. Every time the figure is presented the duck's head

consciousness will appear. If, on the other hand, it is first perceived as a rabbit's head, that particular way of seeing the figure will tend to persist.

The drawing of Fig. 8 may be perceived in several ways. It is easy enough to discover that one continues to see it as a set of steps if one saw it thus at first.

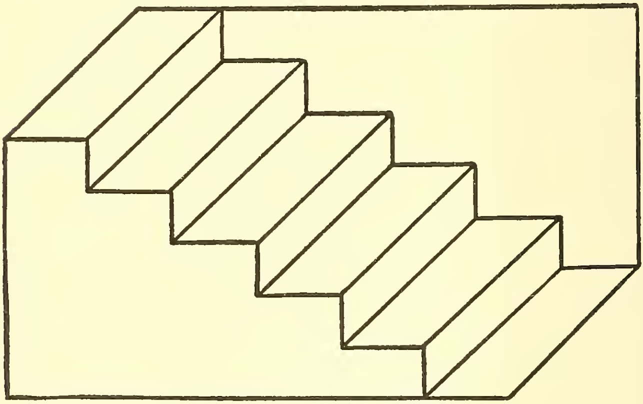

Fig. 8. Multiple perception.

In this phenomenon of the recurrence of a perceptual experience, under conditions which give other persons strikingly different perceptions, we have a particular expression of the general principle of habit.

Law of perceptual supplementation.—Perceptions grow. With each repetition of a perceptual experience new elements are added. Illustration: Thus the protozoan which as I first viewed it with the aid of a microscope was perceived as a jelly-drop moving about and changing shape, acquires new features of structure each time I look at it. The longer, the oftener, the more carefully we examine an object the more complicated our perceptual consciousness of it becomes.

This process of supplementation is due quite as much to the appearance of new feelings and images as it is to new sensations.

To learn to observe means, first of all, to acquire the ability to observe and re-observe until finally one's perception is rich in detail, accurate, and clear. The scientifically trained person sees more in an object, sees it more accurately, and is capable of describing it from memory more satisfactorily than the average observer because he has acquired the habit of persistent attention. He perceives and re-perceives, and with each detail added to the perception his chances of discovering something new are bettered, for the more one sees the more one is likely to see.

CLASS EXERCISE

Self-observation. Introspection of the phenomena of visual contrast and the formulation of generalizations or laws. Materials: Sheets 18 x 18 inches of white, gray, black, red, orange, yellow, green, blue, and violet papers; strips 18 x ½ inches of white, gray, and black papers; sheets 18 x 18 inches of thin tissue paper.

In turn, with intervals between for the writing of accurate accounts of the introspections, the instructor should exhibit to the class the following combinations of papers:

							First Without tissue paper	Second Covered with tissue paper
I.	(a)	White	strip	on	black	paper		
	(b)	Gray	"	"	"	"	"	"
	(c)	Black	"	"	"	"	"	"
II.	(a)	Black	"	"	white	"	"	"
	(b)	Gray	"	"	"	"	"	"
	(c)	White	"	"	"	"	"	"
III.	(a)	Gray	"	"	red	"	"	"
	(b)	"	"	"	orange	"	"	"
	(c)	"	"	"	yellow	"	"	"
	(d)	"	"	"	green	"	"	"
	(e)	"	"	"	blue	"	"	"
	(f)	"	"	"	violet	"	"	"

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CHAPTER XXI

LAWS OF AFFECTION

"An emotional mood, whatever may be its primary origin, tends to persist when once it is aroused, and to fasten upon any object which presents itself. Ill-temper or gloomy depression or hilarity may originate in the first instance in the use of drugs; but when these moods are once in existence they create objects for themselves. A man who gets up in the morning in a bad temper, due to want of sleep or similar causes, is apt to be irritated by almost everything that occurs; though in another mood the same incidents would be received with complacency. The cook angered by her mistress will box the ears of the scullion; a herd of cattle, enraged by the sight of a comrade in distress, will vent their fury on their unfortunate companion; the reason being simply that he is the only object on which their attention is fixed. Their excitement must find an outlet; and in the absence of any other definite channel for it, it discharges itself on the injured animal."—Stout, G. F.: Manual of psychology, p. 129.

A few facts and generalizations concerning affection.—The psychology of the affective aspect of consciousness—of our feelings, emotions, and sentiments—is less advanced along strictly scientific lines than is that of sensation, perception, ideation, and the various aspects of cognitive consciousness. There is a dearth of well-observed facts and a like dearth of generalizations.

The laws of affection are not less important than those of sensation.—It must not be supposed that scientists have consciously chosen to study sensation rather than affection because they considered it of greater practical or theoretical importance. This certainly is not the case, for there is no aspect of our mental lives which is more interesting or of more obvious importance scientifically than affection and its complexes. The truth is that choice of a field of research is influenced more largely by the ease and certainty

with which facts may be observed than by a consideration of relative values. Affection happens to be difficult to study with scientific accuracy. Nevertheless, during the past few years, master psychologists have begun to concentrate attention upon its problems and there is promise of a steady increase in our knowledge of the facts and laws in this field of research.

Even the lack of words for affective experiences may not be accepted as evidence of their slight importance. For it is just because these experiences can not ordinarily be referred to the physical world that we do not name them. We describe objects in cognitive terms, not in affective terms: it is only the exceptional observer who feels the need of a richer language for the description of affective elements and complexes in consciousness.

Varieties of affective experience.—Our affective experiences are of four types: (1) affective elements of consciousness, (2) feelings, (3) emotions, (4) sentiments. For each of these varieties of affection we shall seek generalizations, laws, principles.

GENERALIZATIONS CONCERNING AFFECTIVE ELEMENTS OF CONSCIOUSNESS

Law of properties of affection.—There are four properties common to all affective elements: quality, intensity, duration, and clearness.

Law of the relation of affection to bodily organs.—Affections are not definitely referred to particular bodily organs as are sensations, but they are, instead, referred to the body as a whole. A corollary of this law is the generalization that affections differ from sensations in that they lack "local sign."

Law of relation of affection to bodily processes.—Pleasant feelings are accompaniments of normal healthy

constructive physiological processes—the upbuilding of the body.

Unpleasant feelings as a rule accompany katabolic or destructive physiological processes—the wasting of the body.

Professor Titchener's law of the relation of affection to attention.—" Sensations become clearer as they are observed; affections become less clear. The more closely we attend to a sensation, the clearer does it become, and the longer and more accurately do we remember it. We can not attend to an affection at all. If we attempt to do so, the pleasantness or unpleasantness at once eludes us and disappears, and we find ourselves attending to some obstructive sensation or idea which we had no desire to observe. If we wish to get pleasure from a picture, we must attend to the picture: if, with our eyes on it, we try to attend to our feelings, the pleasantness of the experience is gone." (Outline of Psychology, p. 108.)

This is an admirable generalization for examination introspectively. Every reader should attempt to test the validity of the law. Is it true that we can not attend to affections? Do they differ from sensations as the law claims that they do? Does the affective element prove more difficult of introspective examination than the sensation, and does it have to be observed differently? These questions we may profitably put to the test of observation. The primary question is, What are the facts?

GENERALIZATIONS CONCERNING FEELINGS

Feelings, it is to be remembered, are complexes of affective elements, sensations, and images.

Law of the relation of feeling quality to action.—Agreeable feelings are accompaniments of mutually harmonious and relatively unimpeded activities. Disagree-

able feelings are accompaniments of mutually inharmonious and impeded activities. The one accompanies harmony, the other conflict, in actions. This generalization is thus illustrated by Professor Judd:

"Take the case of a person who is trying to read and hears continually sounding in his ears a noise calling him away from his book. The tendency to respond to the visual stimulations, as exhibited in the active fixing of the eyes on the printed page, is in conflict with the tendency to answer the noise, and the person is conscious of a conflict in his experience. The conflict may be analyzed and may be made the subject of knowledge and thought, but quite apart from this analysis and thought about the conflict of tendencies, there is in experience a disagreeable feeling which is the conscious result of the conflict. The feeling is not a content factor, as are the noise and the printed words; it is rather the experience of restless wavering between contents. It is the characteristic consciousness of inability to settle down to one kind of attention; it is an attitude of effort to secure an adjustment which seems to be just beyond reach.

"Contrast with this feeling of conflict and unpleasantness, the attitude of another person with entirely different active tendencies in the presence of the same noise. Let us suppose that this second person is actively engaged in making all the noise he can. He will welcome the support which comes to his plans and experience from the disturbance that was so unpleasant to the reader. The experience of satisfaction in the second person can not be explained, any more than could the experience of dissatisfaction in the first person, by the quality or intensity of the noise. In both cases, it is a matter of personal attitudes. The whole trend of activity in the noisy individual is congenial to the further reception of sound impressions. The more sounds there are the more easily the response

which he is making can be continued and increased.'' (Judd, C. H.: Psychology, p. 197.)

Law of the relation of intensity of feeling to activity.—The more intense a feeling, beyond a certain point, the less adaptive, serviceable, satisfactory are the reactions of the individual. We behave normally only under conditions of moderately vivid or intense feeling. Persons whose affective experiences are stronger than their sensory experiences are less able to adjust themselves to new situations than are those whose feelings are less influential.

GENERALIZATIONS CONCERNING AFFECTIVE EXPERIENCES FORMULATED BY PROFESSOR WUNDT

The theory of feeling.—We can not to advantage separate Professor Wundt's generalizations in order to present them in logical fashion under the appropriate headings of affective elements, feelings, emotions, and sentiments. Instead we shall consider the various aspects of his view under the above supplementary heading.

Professor Wundt's laws of affection.—(1) The qualities of affection fall into three groups. They are (a) the agreeable-disagreeable affections, (b) the exciting-depressing affections, (c) the tension-relaxation affections.

(2) Each of these groups includes qualities which are psychologically opposites. Thus agreeableness is the opposite of disagreeableness; excitement of depression; and tension of relaxation.

(3) A given affection may possess any one of these three sorts of quality; it may possess a combination of any two, or, finally, it may possess a combination of the three qualitative dimensions.

Professor Wundt thus states and illustrates his view.—''It is greatly to be regretted that the names of simple feelings are so much more hazy than the names of sensa-

tions. The proper nomenclature of feeling is limited entirely to the expression of certain general antitheses, such as agreeable and disagreeable, grave and gay, excited and quiet. . . . This poverty of language in special names for the feelings is a psychological consequence of the subjective nature of the feelings. All the motives of practical life which give rise to the names of objects and their attributes, are here wanting. To infer from this poverty of language that there is a corresponding poverty of affective qualities themselves, is a psychological mistake, which is the more fatal since it renders an adequate investigation of the composite processes impossible from the first.

"In consequence of the difficulties indicated, a complete list of simple affective qualities is out of the question, even more than is a complete list of simple sensations. Then, too, there are still other reasons why it would be impossible to make such a list of feelings. The feelings, by virtue of the attributes described above, do not form separate systems, as do the sensations of tone, of light, or of taste, but all feelings are united in a single manifold, interconnected in all its parts. In this manifold of feelings it is, however, possible to distinguish certain different chief affective series, or dimensions, terminating in affective opposites of predominant character. Such series, or dimensions, may be designated by the two names which indicate their opposite extremes. Each name is, however, to be looked upon as a collective name including a great variety of feelings differing from one another in certain minor individual characteristics.

"Three such chief dimensions may be distinguished. We call them the series of *pleasurable* and *unpleasurable* feelings (a-b, Fig. 9), that of *arousing* and *subduing* feelings (c-d, Fig. 9), and finally, that of feelings of *strain* and *relaxation* (e-f, Fig. 9). Any concrete feeling may belong to all of these dimensions, or it may belong to

only two, or even to only one of them. The last-mentioned possibility is all that makes it possible to distinguish the different directions. The fundamental feeling qualities can be represented in the form of a three-dimensional figure (Fig. 9), the central point of which (n) is the indifference

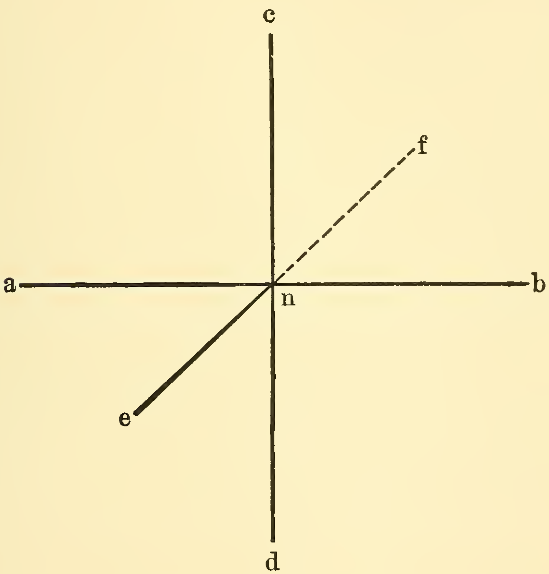

FIG. 9. Representation of Professor Wundt's tridimensional theory of the feelings. a, agreeableness; b, disagreeableness; c, excitement (arousing); d, depression (subduing); e, strain (tension); f, relaxation (relief); n, indifference point.

point. Three lines indicating the three dimensions of feeling pass through this indifference point. A given feeling may lie in one or more of these dimensions.

" Feelings connected with sensations of the general sense and with impressions of smell and taste, may be regarded as good examples of pure pleasurable and unpleasurable

forms. A sensation of pain, for example, is regularly accompanied by an unpleasurable feeling without any admixture of other affective forms. In connection with pure sensations, arousing and subduing feelings may be observed best in the case of color impressions and clang impressions. Thus, red is arousing, blue subduing. Feelings of strain and relaxation are always connected with the processes of attention. Thus, when we expect a sense impression, we note a feeling of strain, and on the arrival of the expected event, we note a feeling of relaxation. Both the expectation and satisfaction may be accompanied at the same time by a feeling of excitement or, under special conditions, by pleasurable or unpleasurable feelings. These other feelings may, however, be entirely absent, and then the feelings of strain and relaxation are recognized as specific forms were recognized as distinct and separate in the examples mentioned before. The presence of more than one affective tendency may be discovered in the case of very many feelings which are, nevertheless, just as simple in quality as the feelings mentioned. Thus, the feelings of seriousness and gaiety connected with the sensible impressions of low and high tones or dark and bright colors, are to be regarded as characteristic qualities which are outside the indifference-zone in both the pleasurable and unpleasurable dimension and the exciting and subduing dimension. We are never to forget here that pleasurable and unpleasurable, exciting and subduing, are not names of single affective qualities, but of dimensions or series, within which an indefinitely large number of simple qualities appear, so that the unpleasurable quality of seriousness is not only to be distinguished from that of a painful touch, of a discord, etc., but even the different cases of seriousness itself may vary in their quality. Again, the series of pleasurable and unpleasurable feelings is united with that of feelings of strain and relaxation, in the case

of the affective tones of rhythms. The regular succession of strain and relaxation in these cases is attended by pleasure, the disturbance of this regularity is attended by the opposite feeling, as when we are disappointed or surprised. Then, too, under certain circumstances the feeling of rhythm may be of either an exciting or a subduing character.'' (Wundt, Wm.: Outlines of Psychology, pp. 90-93.)

The facts upon which Professor Wundt bases his generalizations regarding the dimensions of affections.— Almost the best known of psychological generalizations is the law that feelings express themselves through definite complexes of bodily states. We speak of pictures of the emotions, of expressions of our sentiments and feelings. On the basis of this well-established generalization, psychologists have studied the bodily states which accompany emotions in order to gain knowledge of the emotions themselves. Those bodily states which may most readily and advantageously be observed are the pulse, respiration, knee-jerk, secretion of the salivary glands, and muscle tension. We shall examine only the relation of the pulse action to feelings. And in so doing we shall still further limit our statements to those presented by Professor Wundt in support of his tridimensional theory.

Method of studying bodily expressions of the emotions.—Accurate ways of getting records of the rate and character of the heart-beat of a person who is experiencing an emotion are numerous and not exceedingly difficult of manipulation. Consequently numerous records are available. By comparing the rate and strength of the heart-beat with the emotions experienced by the subject, Professor Wundt arrives at the following correlation between affection and pulse. It should be stated that other observers have not succeeded in verifying certain of these results.

Pleasant feelings	pulse retarded and intensified.
Unpleasant feelings	pulse accelerated and weakened.
Exciting feelings	pulse strengthened.
Depressing feelings	pulse weakened.
Tension feelings	pulse retarded and weakened.
Relief feelings	pulse accelerated and intensified.

The peculiar nature of this generalization.—The tri-dimensional theory is stated in this chapter not because it is generally accepted or even because it has a reasonably sound observational basis, but solely because it offers a splendid opportunity to call attention to one variety of generalization, namely, that which springs from the mind of the scientist as the result of certain preëxistent ideas and logical schemes rather than of observed facts.

An examination of the three pairs of feelings suggested by this scheme reveals at once that provided the pulse varies with respect to two characteristics and two only, rate of beat and strength or intensity of beat, there are eight possibilities: (1) The rate remaining the same, the strength may increase; (2) the rate remaining the same, the strength may decrease; (3) the strength remaining the same, the rate may increase; (4) the strength remaining the same, the rate may decrease; (5) both rate and strength may increase; (6) both rate and strength may decrease; (7) rate may increase and strength decrease; (8) rate may decrease and strength increase. But provided the rate never varies independently of the strength, there are only six possibilities, i.e., numbers (1) and (2) drop from our series of possibilities.

It looks like a logical and convenient scheme rather than one which is true to the facts, but it would be utterly unscientific to condemn it upon this basis. It must be admitted, however, that it has not stood the test of observation very satisfactorily. But even if it should be proved to be

incorrect in certain respects (and it doubtless is) it may serve to lead us to a correct generalization. For it occurs not infrequently that brilliantly imaginative investigators present as theories generalizations which stimulate research by virtue of their apparent artificiality. The tridimensional theory is doing excellent service to the science of psychology by stimulating the experimental investigation of the variation of bodily states in correspondence to variations in feelings.

GENERALIZATIONS CONCERNING EMOTIONS

The James-Lange law.—This law of the relation of our emotions to bodily changes is thus phrased by Professor James: "Bodily changes follow directly the perception of the exciting fact, and our feeling of the same changes as they occur is the emotion."

This law serves to identify emotional experiences with certain complexes of organic sensations and their accompanying affections. Is the generalization correct? Is the emotion merely certain sensations plus certain affections? Certainly it must be if these are the only kinds of conscious elements.

The statement has the great merit of calling our attention to the probable constitution of emotional experience. Previously to the James and Lange discussion of the subject, the organic sensations were supposed to precede the emotion and to be wholly different from it. They are now recognized as an important part thereof. As Professor James vividly puts it, the emotions would not exist were the sensations lacking. "Common sense says, we lose our fortune, are sorry and weep; we meet a bear, are frightened and run; we are insulted by a rival, are angry and strike. The hypothesis here to be defended"—and it is to be noted that Professor James does not admit his state-

ment to the realm of law—'' says that this order of sequence is incorrect, that the one mental state is not immediately induced by the other, that the bodily manifestations must first be interposed between, and that the more rational statement is that we feel sorry because we cry, angry because we strike, afraid because we tremble, and not that we cry, strike, or tremble, because we are sorry, angry, or fearful, as the case may be. Without the bodily states following on the perception, the latter would be purely cognitive in form, pale, colorless, destitute of emotional warmth. We might then see the bear, and judge it best to run, receive the insult and deem it right to strike, but we should not actually feel afraid or angry.'' (James, Wm.: Principles of Psychology, vol. 2, pp. 449-450.)

Law of the relation of emotion to bodily conditions.— Every emotion has its definite and fairly constant bodily concomitants. It is therefore quite proper to speak of the bodily picture of an emotion, meaning thereby the complex of physiological conditions which is regularly accompanied by a certain emotion.

Darwin thus describes the bodily picture of extreme fear: '' The frightened man at first stands like a statue motionless and breathless, or crouches down as if instinctively to escape observation. The heart beats quickly and violently, so that it palpitates or knocks against the ribs; but it is very doubtful whether it then works more efficiently than usual, so as to send a greater supply of blood to all parts of the body; for the skin instantly becomes pale, as during incipient faintness. This paleness of the surface, however, is probably in large part, or exclusively, due to the vaso-motor center being affected in such a manner as to cause the contraction of the small arteries of the skin. That the skin is much affected under the sense of great fear, we see in the marvelous and inexplicable manner in

which perspiration immediately exudes from it. This exudation is all the more remarkable, as the surface is then cold, and hence the term a cold sweat; whereas, the sudorific glands are properly excited into action when the surface is heated. The hairs also on the skin stand erect; and the superficial muscles shiver. In connection with the disturbed action of the heart, the breathing is hurried. The salivary glands act imperfectly; the mouth becomes dry, and is often opened and shut. I have also noticed that under slight fear there is a strong tendency to yawn. One of the best-marked symptoms is the trembling of all the muscles of the body; and this is often first seen in the lips. From this cause, and from the dryness of the mouth, the voice becomes husky or indistinct, or may altogether fail.

"As fear increases into an agony of terror, we behold, as under all violent emotions, diversified results. The heart beats wildly, or may fail to act and faintness ensue; there is a death-like pallor; the breathing is labored; the wings of the nostrils are widely dilated; there is a gasping and convulsive motion of the lips, a tremor on the hollow cheek, a gulping and catching of the throat; the uncovered and protruding eyeballs are fixed on the object of terror; or they may roll restlessly from side to side. . . . The pupils are said to be enormously dilated. All the muscles of the body may become rigid, or may be thrown into convulsive movements. The hands are alternately clenched and opened, often with a twitching movement. The arms may be protruded, as if to avert some dreadful danger, or may be thrown wildly over the head. The Rev. Mr. Hagenauer has seen this latter action in a terrified Australian. In other cases there is a sudden and uncontrollable tendency to headlong flight; and so strong is this that the boldest soldiers may be seized with a sudden panic.

"As fear arises to an extreme pitch, the dreadful scream of terror is heard. Great beads of sweat stand on the skin. All the muscles of the body are relaxed. Utter prostration soon follows, and the mental powers fail." (Darwin, Chas.: Expression of the Emotions in Man and Animals, pp. 290-292.)

Law of the relation of the intensity of an emotion to its duration.—The more intense an emotion the shorter its duration. Extremely strong emotions are fatiguing and can not long be sustained.

Law of the relation of emotions to memory.—The more vivid the emotional escort of an experience the longer it is likely to be remembered and the more readily and clearly it can be recalled.

GENERALIZATIONS CONCERNING SENTIMENTS

Law of the acquisition of sentiments.—The more frequently a marked affective experience has come to us in connection with a particular person or thing the more likely we are to acquire a sentiment—sentimental attitude—for the object. I have a sentimental relation to the house in which I was born just because of the many varied, vivid, and oft-repeated feelings and emotions which are associated with my consciousness of the object. For the shapeless puppy, which I rather reluctantly accepted as a gift, I rapidly acquired a sentimental attachment because of the affective experiences which became associated with my consciousness of the animal. Feelings and emotions spring up spontaneously, suddenly, whenever the conditions appear; but sentiments grow. They are, rather, complex affective attitudes or prejudices than kinds of affections. With reference to the person whom I love it is practically impossible for me to be fair in judgment because of my general feeling attitude. If I hated the individual it

would be equally difficult for me to be fair or to experience agreeable feelings and emotions in connection with the person.

Laws of æsthetic experience.—All of the fine arts depend upon psychological laws and it is known that they succeed in the measure to which they conform to these laws. But oddly enough most of the laws have not been formulated. The painter strives for a certain effect which he calls good. He knows what pleases him, he recognizes the beautiful when he sees it, but he can not state a general principle which would enable any one to get the desired effect. The musician composes according to certain inner promptings without the power to put into general terms the requirements which his composition must fulfill if it is to prove artistic. The milliner, the house decorator, the landscape architect work likewise by a more or less blind process of trial. Every separate attempt is a law unto itself. This should not be the case. There are certain fundamental psychological principles which should be clearly formulated and recognized by all those who strive for pleasing effects.

Examples of æsthetic laws.—Experiences of red, orange, yellow are predominantly exciting, while either agreeable or disagreeable. Experiences of green and blue are predominantly quieting, soothingly restful, while either agreeable or disagreeable. This seems to be true of the elements of consciousness. And in every complex of elements the laws manifest themselves. For example, to paper a room which is intended to be quieting, restful, cool, with deep or brilliant red paper is absurd. This is true because the color—quite apart from other conditions—has just the opposite affective accompaniment from that desired. To paper a dark, chilly, cheerless room in dull deep blue is equally unsatisfactory, for it adds to the disagreeableness of the situation instead of relieving it.

For a given individual, similar laws are found to hold of auditory sensations. High tones and certain qualities of noise, rasping, grating, scraping, are uniformly unpleasant, cutting, tearing, or chilling. Some seem to pierce the organism, others seem to make one's blood run cold. Medium tones and certain qualities of noise—snaps, cracks, clicks—are uniformly accompanied by a pleasant feeling, unless there are other factors entering to render the total feeling unpleasant.

Examination seems to indicate that these laws are capable of far more definite formulation for the race than has usually been supposed. Our likes and dislikes are less individual, less freakish, more fundamental and more generally shared by our fellows than we are wont to think.

Law of the emotional value of repetition.—Rhythmic experiences are more agreeable than those which are broken, irregular, non-rhythmic. This too is generally true and doubtless fundamental. Irregular sounds or touches or flashes of light—irregularities in works of art: in music, painting, sculpture, architecture—are to be avoided or compensated. A certain kind of regularity is the natural demand of the organism. Every bodily process is regular and many are rhythmic. Doubtless this is the physiological basis for our appreciation of psychological rhythms.

Law of unity in relation to agreeableness.—Unity in experience is a condition of æsthetic pleasure. If an experience is incomplete, inharmonious because of conflicts with other experiences, it is unpleasant.

Independence in experience is a condition of pleasure. An experience should be complete in itself, it should not reach beyond for something else to finish or supplement it, it should not suggest other parts. It must have unity and isolation.

CLASS EXERCISE

Self-observation. Introspection of certain sentiments.

(1) Examine your consciousness of a certain food which you especially like or dislike. Search consciousness for explanations of the sentiment.

(2) Examine similarly your consciousness of a person whom you markedly like or dislike. Describe fully your affective consciousness and attempt to discover the chief steps in the growth of the sentiment.

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Witmer, L.: Analytic psychology, chapter 3.
Myers, C. S.: Experimental psychology, chapter 25.

CHAPTER XXII

LAWS OF ATTENTION

"Suppose, then, that I am working or reading quietly, and that a telephone message or the entrance of a visitor suddenly demands my attention. The first thing that happens is that there is a redistribution of the entire contents of consciousness. The incoming ideas—my friend's business or the subject of the message—drive to the center, and everything else, my previous occupation as well as my sensory surroundings, are banished to the outskirts. Consciousness, in attention, is patterned or arranged into focus and margin, foreground and background, center and periphery. And the difference between the processes at the focus and the processes in the margin is, essentially, a difference of clearness: the central area of consciousness lies clear, the more remote regions are obscure. In this fact we have, indeed, the key to the whole problem of attention. In the last resort, and in its simplest terms, attention is identical with sensory clearness.

"However, we must confine ourselves to observation, and not anticipate. The attentive consciousness is arranged as clear and obscure: so much is evident. Is the consciousness affective? Not necessarily. We may greet our friend with an absorbed interest, with pleasurable concern or with foreboding of unpleasantness; but we may also give him a perfunctory and mechanical attention, which leaves us wholly unaffected. Is the consciousness kinæsthetic? Again, not necessarily. There may be a widespread arousal of kinæsthetic sensations, or there may be no sensible change in the muscular system: it depends upon circumstances. So that it appears, even to unaided introspection, that the redistribution of contents into the groups of clear and obscure is the one universal and characteristic feature of the attentive consciousness."—TITCHENER, E. B.: Text-book of psychology, pp. 266-267.

Mental life, like bodily life, consists of processes.— At times in the development of the science of psychology there has been a tendency to think of mind as made up of a number of more or less independent faculties. For every special variety of experience there was supposed to exist a creative faculty. Thus attention was considered a condi-

tion of mind which results from the activity of the faculty of attention; association, an experience which is indicative of the functioning of the associative faculty; memory, a result of the exercise of the faculty of remembering.

This conception of the mind as a bundle of active agencies or faculties is now regarded as unprofitable, and in its place we have the notion that mental life is a complex collection of interrelated processes, similar, in essential respects, to the physiological processes which together constitute bodily life. Attention from this point of view is but one of the multitudinous processes which occur as portions of the life of experience. Association is simply one of the varieties of change which go to make up our total consciousness. Memory is a process which occurs side by side with attention, association, perception, thought, and often inextricably interwoven with one or more of them.

There is no faculty of attention, of association, or of memory.—No special agent or agents attend to these particular kinds of consciousness. They are aspects of consciousness. At the same instant our experience may present attentional, associational, recognitive, and many other processes. We must dispel from our minds the idea that there is something in us which attends, or associates, or remembers. To be conscious means to attend, to associate, to remember, to perceive, to feel, to will, and many other things, but not all of these processes occur at the same time or with equal prominence.

ATTENTION

What do we mean by attention?—The word has been variously defined and often with skill and insight. For us it shall mean a condition of a given bit of consciousness within the stream of consciousness. It is the clearness, vividness, or distinctness of the mental content. That

which is clear is attended. Attention varies in degree. At any given moment, I am aware of many things, my consciousness is complex and varied, but I am not aware with equal clearness of these several things. Some are vaguely before me, others are fairly clear, and still others, or perhaps another, are perfectly distinct. These are grades or levels of attention. Where perfect clearness of mental content exists, the attention process is at its best. It is functioning at its maximum efficiency. Where vagueness exists, the attention process is functioning partially and incompletely. Every fragment of experience passes from a minimum of clearness to a more or less high degree of clearness ere it fades from consciousness. Only a portion of the mass of material which makes up our stream of consciousness ever attains the maximum of attention value.

Clearness and sleep.—It is the writer's practice to describe consciousness as consisting of at least four levels: (1) the subconscious level, (2) the unclear conscious level, (3) the introspective level, and (4) the level of maximal introspective clearness.

The study of attention therefore becomes a study of clearness and its conditions.—If attention may be defined as the state of being clear, then the laws of attention evidently must be the laws of mental clearness. Accepting this conclusion, we shall now attempt to describe in general terms the important conditions of mental clearness or attention. The question which should remain uppermost in our minds the while we examine this subject is, Under precisely what circumstances or conditions is a particular bit of experience clear? Or, differently expressed, What factors seem to determine the degree of clearness of experiences? When we have satisfactorily answered this question, we shall know what attention is and why it is of so great importance in mental life.

GENERALIZATIONS CONCERNING ATTENTION

Law of the relation of intensity to attentional clearness.—Other things being equal, the greater the intensity of an experience the greater its clearness. Illustration: A loud noise, an intense light, a sudden change in temperature is accompanied by marked attentional clearness of experience. But, of course, there are many other conditions of attention and it frequently happens that the intense experience is overshadowed by one which is less intense, simply because the latter possesses some property which has greater importance for attentional clearness than has mere intensity.

Law of the relation of quality of sensation to attentional clearness.—Those qualities of sensation whose regular accompaniment is a disagreeable affection as a rule possess a higher degree of clearness than do other sensations. Illustration: As Professor Titchener points out in "The Psychology of Feeling and Attention," there are certain pains, odors, tastes, sounds, sights which are urgently, insistently, and importunely clear; they are intimate, worrying, wicked things. There seems to be something about the quality of the sensation itself, quite apart from its disagreeable sense-feeling, which renders it intensely clear.

Law of the relation of quality of affection to attentional clearness.—Of two affections whose intensity is the same, the disagreeable is clearer than the agreeable. Painful experiences compel attention; pleasurable ones attract it.

Law of the relation of suddenness of appearance of a sensation or affection to attentional clearness.—The more suddenly and unexpectedly a sensation or affection breaks in upon the stream of consciousness the clearer it is likely to be. Illustration: The sudden flash of light

brings its sensation to the height of clearness while a slow flash possesses less attentional value. The sudden electric shock wholly occupies consciousness for an instant. Perhaps, in this connection, suddenness and unexpectedness should be separated, for it is well known that a sudden stimulus may not compel attention if it is expected.

Law of repetition.—The repetition of an experience tends at first to increase its clearness, but beyond a certain limit it tends rather to diminish it. This is probably a case of the summation of stimuli and therefore to be considered as a matter of increase in intensity.

Law of change in relation to clearness.—A stimulus which changes rapidly or jerkily commands greater clearness than do others. The moving touch, light, or sound attracts attention. A fluctuation in the stimulus seems necessary. It is not the intensity of the light which most effectively holds the eye but the variations in intensity.

Law of relation of clearness to usualness.—The less one is accustomed to an experience, the clearer it is. Novelty, strangeness, rarity, are important conditions of clearness. A new sound is startling, especially if heard in strange surroundings. A new object compels attention.

Law of the relation of resemblance in consciousness to clearness.—If a new sensation, feeling, or idea happens to be like one already in consciousness, the new one is clearer than it otherwise would have been. The way seems to be prepared for it and it immediately springs to the forefront of clearness. This seems to contradict the law of novelty and unexpectedness. Does it? How can we harmonize the two?

Law of levels of attention.—For each observer, under definite conditions of introspection, a certain number of distinguishable grades, degrees, or levels of clearness exists. The number differs apparently with individuals as well as with conditions of observation. For some there exist only

two grades: an experience is either clear or unclear; for others there are three, four, or more distinguishable degrees of clearness.

The writer recalls in this connection, his introspection concerning the feeling of certainty. It seemed to him possible, as he attempted to describe from memory a number of simple objects, to distinguish from three to five grades of certainty and these he felt to be closely related to the clearness of his perceptions of the objects. He therefore believes that he experiences from three to five distinguishable degrees of clearness.

The reader has but to glance for an instant at a group of objects—a store window, the dinner table, a book shelf—and then looking away, to attempt to describe what has been seen in order to discover the fact of levels of clearness and grades of certainty. The introspective experience is decidedly worth while.

Law of the range of attention.—There is a definite limit, for a particular observer and under definite conditions, to the number of items of experience which may at a particular moment possess maximal clearness. The old query, How many different things may one be conscious of at the same time? has been answered by the experimental psychologist. The number depends upon the nature and relations of the experiences. Thus at a given moment one may be aware of four, five, or six objects visually, tactually, or auditorily. The more readily the objects may be grasped as a group the larger the number of impressions which may be attended to simultaneously. Thus, a word is really a single object because its letters so readily fuse in the consciousness of meaning. So, likewise, is the series of sounds which forms the unit of a rhythm. Tick-tack is a single object of experience, not two objects.

Undoubtedly the span of attention varies greatly with individuals and with conditions. One may by practice

acquire skill in grasping a large number of impressions even though they be difficult to relate to one another.

Law of the duration of attention.—Nothing long continues in consciousness at maximal clearness. Attention fluctuates: it is discontinuous, interrupted. As I attempt to listen to my watch, I discover that every now and then the sounds become unclear or even disappear entirely from my consciousness. It is only under special conditions that any experience may be held clearly in consciousness for more than a few seconds. Normally consciousness is constantly changing not only in content but in the relative clearness of the parts of its content. Now I hear the watch tick, now I am conscious of the wind. This fluctuating of the attention—variation in the clearness of an experience—is one of nature's economies, for it is extremely fatiguing to attend to anything continuously, or even to attempt to do so.

The conditions of attention.—The generalizations already formulated are sufficient to indicate that our most direct and profitable approach to attention is through the study of the psychological and physiological conditions which influence it.

A number of these conditions, many of which have been noted in our laws, are mentioned by Professor Pillsbury in his thoroughgoing discussion of the psychology of attention. He names as preëminently important factors in attention (1) intensity of sensation, or of perceptual and ideational complexes, (2) change in the intensity of sensation, (3) the summation of stimuli, (4) suddenness of change in the properties of a sensation, (5) the extensity of stimuli (voluminousness of sensations), (6) duration, (7) novelty, (8) preparedness, (9) affective elements, (10) associations.

Psychology is apparently on the eve of an experimental investigation of attention which will vastly in-

crease the scope and accuracy of our knowledge of the subject.

CLASS EXERCISE

Self-observation. The introspection of attention. (1) Listen intently to the ticking of a watch held before the class by the instructor. Note any changes in the clearness of the sounds. Note also the disappearances of the sounds and the nature of consciousness during the intervals.

(2) Introspect your consciousness of a joke read by the instructor. How is the clearness of your emotional consciousness influenced by your attempts to observe it?

(3) How long can you attend steadily to a faint sound, a picture, an idea of fatigue? How long can you hold clearly the image of this morning's breakfast table or of any part of it?

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CHAPTER XXIII

LAWS OF ASSOCIATION AND MEMORY

"A detailed comparison of visual images of memory and of imagination brings out the following differences: memory involves eye-movement and general kinæsthesis, imagination involves steady fixation and lack of general kinæsthesis; memory images are scrappy, filmy, and give no after-images, while images of imagination are substantial, complete, and sometimes give after-images; the mood of memory is that of familiarity or recognition, intrinsically pleasant, the mood of imagination is that of unfamiliarity or novelty, intrinsically unpleasant; memory implies imitative movement and the correlated organic sensations, imagination implies kinæsthetic and organic empathy; memory images arise more slowly, are more changeable in course, and last less long than images of imagination; memory implies roving attention and a mass of associative material, while imagination involves concentrated and quasi-hypnotic attention with inhibition of associations.

"We thus reach the general conclusion that the materials of imagination are closely akin to those of perception. Popular psychology looks upon memory as a photographic record of past experience, and regards imagination as working with kaleidoscopic, instable, undependable materials. Precisely the reverse appears to be true. The image of memory is stable and fixed in meaning, in reference; but it is exceedingly instable as conscious content. The image of imagination is the photographic record, a stable formation that stands still to be looked at. This state of affairs seems, indeed, after the event, natural enough. It is just because the memory image is instable, liable to all sorts of interchange, suppression, short-cutting, substitution, telescoping, that it is psychologically available for memory; that a mass of past experience can be packed into small representative compass. And it is just because the image of imagination is stable and unchanging that it is psychologically available for the artistic purpose, for constructive embodiment. If an image could not decay, we should have but little memory; if an image could not persist, we should have but poor imagination."—PERKY, C. W.: An experimental study of imagination. *American Journal of Psychology,* vol. 21, p. 451. 1910.

ASSOCIATION

The meaning of association.—At bottom association means that mental processes are related to one another

instead of being isolated and relatively independent. They tend to run together without losing their identity; they become associated. Sensations and affections become associated in those experiences which we call perceptions. Sensory and affective images become associated in ideas. Ideas become associated in still more complex ideas or in thoughts. There are many kinds of association for which terms have been coined. The most intimate of associations appears in total fusion of mental processes; the least intimate, in the linking of one idea with another because they happen to follow one another in experience.

GENERALIZATIONS CONCERNING ASSOCIATION

General law of association.—When two sensations, affections, or other experiences, occur together or successively they tend to form a whole and are said to become associated. Later the appearance in consciousness of one of the experiences tends to be followed by the appearance of the other.

The general law of association is thus formulated by Professor Thorndike: "The likelihood that any mental state or act will occur in response to any situation is in proportion to the frequency, recency, intensity, and resulting satisfaction of its connection with that situation or some part of it and with the total frame of mind in which the situation is felt." (Elements of Psychology, p. 207.)

The associational train.—Happy are those persons who are born to introspection and for whom following a train of ideas is easy! But happier far the person who by dint of prolonged attention and effort finally succeeds in introspecting his associative processes. In this task, it is a good resolution never to become discouraged, for at the least expected moment success is likely to come to one. A train

of ideas will suddenly stand out clearly before one with the relations so plainly exhibited that those who run may read. It is joyous surprise that such an experience brings. The writer is not a born introspectionist and he has had the surprise. Here is one of the fruits of his introspection of his associative processes.

The thought of a physician's office suggested to me a chance meeting with an acquaintance at the Harvard Medical School. I was vividly conscious of the place of meeting, the details of our surroundings were vaguely visualized, as was also the man with whom I was talking. I tried to think of his name and failed. A moment passed, and during that interval the following train of ideas appeared. The name Gall (a famous phrenologist) came to mind, but I knew that was not the name I sought. It immediately brought in its trail the name Spurzheim (also a phrenologist), which in turn I recognized as aside from my goal. That quickly carried me to a second-hand book shop in Boston where a few years ago I chanced to see a volume by Doctor Spurzheim. It was the second volume of two, and while searching for the first one, I chanced upon a copy of Doctor Benjamin Rush's essays on the mind. The instant the name Rush came to consciousness I felt relief, elation, and partial recognition. I thought at once of the old Philadelphia physician, Doctor Rush, and of what I happened to know about the acquaintance whose name eluded me. As I was pondering the facts and wondering why I could never recall his name when I wanted it, it suddenly flashed through my mind that Rush was not his name, that I had had just the same experience some months before and had even asked a friend whether the Doctor Rush in question was related to the famous Philadelphia physician. Upon being told that his name was not Rush at all, I had been greatly surprised and chagrined. This revival of my former strongly affective experience brought to mind the

consciousness that the name I sought was Rushworth instead of Rush.

The train of perceptions, images, ideas, feelings, and thoughts, which I have thus briefly sketched, was so vividly and diagrammatically clear when I asked myself how I recalled the name that I took great satisfaction in working out the course of my ideas and their evident relations. Let me suggest the inner relations which I know to have been important.

Gall came to consciousness because only a few hours previously I had been reading a psychological book in which mention was made of the founder of phrenology. It naturally carried me to the book shop where I had sought Spurzheim's book on phrenology and had found Doctor Rush's on mind. The discovery of my mistake I attribute to the highly affective character of my earlier mistake. Why the name Rushworth flashed into consciousness just when it did I can not explain. But at least I have given the prominent links in the chain of ideas which led me to it.

Law of the relation of association to the resemblance of things associated.—The tendency of two experiences to become associated varies directly with their similarity. The face of a stranger calls up in my mind that of a friend which is markedly similar. The sound of a foreign word calls up a similar word in my own language. Points of resemblance condition associations. Like becomes linked with like. This is the law of association by similarity.

Law of the relation of association to temporal contiguity.—Experiences which appear in consciousness either simultaneously or in immediate succession tend to become associated. The closer they are together the stronger the tendency to association. A sudden flash of light brings to mind the roar of thunder because the latter is associated with lightning.

Laws of frequency, recency, and vividness in association.—The more frequently, recently, or vividly two experiences have appeared in consciousness either simultaneously or in immediate succession the stronger the tendency for them to become intimately associated. Illustration: The odor of new mown hay brings with it the idea of warmth because of the frequency with which the two experiences have been presented. The sound of the wind leads me to consciousness of beating waves because of a recent experience in a storm. The single experience of confusing the names Rush and Rushworth, with its vivid emotion of chagrin, now causes the former name to suggest the latter.

Law of the relation of association to affection.—The more intense and clear the affective accompaniments of items of consciousness which occur together the more likely they are to become associated. Illustration: A particular name is ineradicably associated with a certain scene because of an intensely disagreeable emotion once experienced. The word weak-fish is associated with Beach Haven because of strong agreeable emotions there experienced.

Types of association and the individual.—There are several types of association. Important among them are (1) association by co-ordination—boot-shoe, hat-cap, board-plank; (2) association by super-ordination—dog-animal, chair-furniture, book-library; (3) association by subordination—animal-dog, furniture-chair, desk-drawer; (4) association by contrast—right-wrong, cellar-attic, black-white.

Professor Myers offers the following classification of associations. (Text-book of Experimental Psychology, p. 152.) It is logical rather than psychological. Consequently, a given association may be certainly placed in the scheme only in the light of introspection.

Similarity	in meaning	co-ordination	e.g. baby—infant
		superordination	e.g. soldier—man
		subordination	e.g. man—soldier
		contrast	e.g. peace—war
	in sound	in letters or syllables	e.g. port—porter
		in rhyme	e.g. fight—kite
Contiguity	in time	causal	e.g. lightning—thunder
		verbal	e.g. one—two, snow—snowball
	in space		e.g. handle—lock

The best way to master the scheme and at the same time to test its value, is by attempting to distribute a series of actual associations among the classes.

Habit and association.—The principle of habit is identical with that of association. Habit is usually applied to certain forms of behavior; association to certain forms of experience. Instinct is used with equal frequency to designate certain inherited combinations of acts, and certain inherited connections of sensory and affective experiences. Professor Thorndike has combined the laws of habit, association, and instinct in one statement thus: "The likelihood that any mental state or act will occur in response to any situation is in proportion to the closeness of its inborn [instinct] connection therewith, to the frequency of its connection therewith, and to the amount of satisfaction resulting." (Thorndike, E. L.: Elements of Psychology, p. 205.)

The fundamental importance of association.—Habit, instinct, and association are expressions of one fundamental organic principle, the principle of uniformity. What has happened tends to happen again. Without instincts life would be practically impossible; without habits

our lives would be irksome; without associations they would be chaotic, a mere succession of unrelated experiences.

In this chapter we have considered under the heading association many of the facts and laws which are customarily discussed under habit. The reason for this is that we are concerned primarily with the linking of mental processes—psychic association—and not with the linking of acts—physiological connections.

MEMORY

Memory is a process in consciousness which has a distinctive mark. The mark of the remembered experience is the feeling of familiarity. So long as there is no feeling of "at home" we are not remembering, although we may be re-living an experience. One may experience the same emotions day after day, yet if they always seem new and feel unfamiliar they may not be called memories. We remember when we recognize and identify and place a particular experience in its relations to previous experiences. The face of the man whom I passed a few moments ago I partially recognized for I felt certain that I had seen it before, but not until I had definitely located my experience of the face by recalling the place and circumstances of my previous experience did the complete characteristic recognitive feeling of familiarity come upon me.

The imperfection of memory.—We remember more or less perfectly, completely, accurately, clearly. It is seldom indeed that a complex experience is re-lived precisely as it was originally experienced. As a rule the feeling of familiarity comes to us when we recall and definitely place in our mental life the essential features of an experience. To my friend's query, I quickly reply that I remember a particular event, if I can recall anything about it. My

memory may be extremely meager, incomplete, inaccurate. Indeed, when I attempt to describe the event it may become apparent that I am imagining, borrowing from other more or less similar experiences, much more than I am remembering.

GENERALIZATIONS CONCERNING MEMORY

Relation of memory to association.—The more numerous and well established the associational connections of an experience the more readily, certainly, and accurately can it be remembered. No associative processes, no memory.

Naturally, the conditions which favor the formation of associations also favor recall.

The general law of memory.—Experiences, with repetition, tend to acquire an affective accompaniment called the feeling of familiarity.

Law of frequency.—That experience is best remembered which has most frequently been presented. Mere repetition favors recall. Illustration: I recall my telephone number more readily, with a more intimate feeling of familiarity and more certainly, than I do that of a friend simply because I have more frequently seen, heard, pronounced, written, and thought it.

Law of recency.—Other things being equal, that is best recalled which was most recently experienced. Illustration: I readily and accurately remember what I have written to-day, but only with difficulty and uncertainty can I remember what I wrote a week ago. Vividly and in detail I recall views of the Panama Canal which I experienced last summer; but only in vague outline and uncertainly can I remember the appearance of a German village which I visited ten years ago. The description of Thomas B. Aldrich's home at Ponkapog which I read last night, I

remember more accurately and readily than a description of the Vatican which I read last year.

Law of vividness.—The more vivid an experience the more readily and accurately is it recalled. Illustration: The scene of a runaway is clearly before me now—I saw it twenty-five years ago under intense excitement. I clearly remember a phrase of which I was once vividly conscious, although I can not recall the face of the speaker.

Law of affective accompaniment.—Experiences which are markedly agreeable or disagreeable are recalled more readily than those which are affectively neutral. Illustration: How painfully clear is the memory of a social blunder! How vivid the recollection of an unintentional injury to a friend!

Memory, as revival of previous experience depends upon:—(1) The number and strength of the associational connections which the experience possesses. These in turn depend chiefly upon the frequency of its occurrence. (2) The clearness or vividness of the experience. This is determined by conditions already discussed under Attention. (3) The affective value of the experience.

GENERALIZATIONS CONCERNING LEARNING OR MEMORIZING

Experimental studies of learning.—Recently the psychology of learning has been carefully investigated, in the cases of the acquirement of skill in making simple movements (typewriting), memorizing nonsense syllables, poems, or pages of prose, and the acquisition of habits involving some definite act or acts of discrimination. The following generalizations are based upon the results of these studies:

Law of temporal distribution of practice.—"A lesson is better retained when the learning extends over a considerable period of time, than when the task is learnt by the same number of repetitions at a single sitting." Brief

intervals of practice—repetition for memorizing—are more valuable than long-continued practice. Illustration: A poem can be more effectively and economically memorized by reading it over five times daily on four successive days than by reading it twenty times at the first attempt.

With such animals as mice, rats, cats, dogs, monkeys, as well as with children, it is relatively easy to demonstrate that a given habit is more rapidly acquired and longer retained if the training be distributed over a few days than if it be given all at once.

Law of complete repetition.—We learn more satisfactorily by taking what is to be learned as a whole rather than bit by bit. Illustration: If a complex series of acts, as in the typewriting of a sentence, is to be learned it can be done more efficiently by going through the entire process line after line than by practising first on one word or phrase, then on another. If a poem or paragraph of prose is to be memorized, it is more economical of time and yields more lasting results if the passage be read through from end to end each time instead of being taken sentence by sentence.

This is evidently a matter of meaning. We come to understand, as a whole, what we are trying to master.

Law of relation of meaning to learning.—The better what is to be learned is understood the better it can be remembered. Thus one observer finds " that he can learn six stanzas of Byron's " Don Juan " at a single sitting in fifty-two repetitions. Each of these stanzas contains about eighty syllables in about thirty-six words, when articles, prepositions, pronouns, and similar dependent words are left out of account. But he has experimentally shown that thirty-six senseless syllables require fifty-five repetitions; whereas a single stanza of poetry requires about eight repetitions. We have thus some measure of the astonishing saving effected by rational associations in the learning of

sensible matter." (Myers, C. S.: Text-book of Experimental Psychology, p. 179.)

Other aspects of learning.—The generalizations which have been presented are merely examples of the laws of memorizing. The psychology of learning is especially important in connection with educational methods and we shall therefore consider it further in the discussion of "Education as control of consciousness" (chapter XXXI).

CLASS EXERCISE

Self-observation. Introspection of associations. 1. The instructor should read off, at the rate of six words per minute, a list of one hundred words. As each word is announced, the student should write it on a sheet of record paper, together with the word which it brought to consciousness (the first association).

2. After the list of one hundred associations has been obtained, each member of the class should classify them according to Professor Myers' scheme.

3. Finally the results should be submitted to some member of the class for a general report.

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Myers, C. S.: Text-book of experimental psychology, chapters 12, 24.
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PART FIVE

PSYCHOLOGY AS EXPLANATION AND CORRELATION

CHAPTER XXIV

PHYSICAL AND PSYCHICAL EXPLANATION

" Projecting nearly horizontally from the upper deck of the ferry boat on which I daily cross the river, is a long white pole, bearing a gilded ball at its tip. It suggested a flagpole when I first saw it; its color, shape, and gilded ball agreed with this idea, and these reasons seemed to justify me in this belief. But soon difficulties presented themselves. The pole was nearly horizontal, an unusual position for a flagpole; in the next place, there was no pulley, ring, or cord by which to attach a flag; finally, there were elsewhere two vertical staffs from which flags were occasionally flown. It seemed probable that the pole was not there for flag-flying.

" I then tried to imagine all possible purposes of such a pole, and to consider for which of these it was best suited: (a) Possibly it was an ornament. But as all the ferryboats and even the tugboats carried like poles, this hypothesis was rejected. (b) Possibly it was the terminal of a wireless telegraph. But the same considerations made this improbable. Besides, the more natural place for such a terminal would be the highest part of the boat, on top of the pilot house. (c) Its purpose might be to point out the direction in which the boat is moving.

" In support of this conclusion, I discovered that the pole was lower than the pilot house, so that the steersman could easily see it. Moreover, the tip was enough higher than the base, so that, from the pilot's position, it must appear to project far out in front of the boat. Moreover, the pilot being near the front of the boat, he would need some such guide as to its direction. Tugboats would also need poles for such a purpose. This hypothesis was so much more probable than the others that I accepted it. I formed the conclusion that the pole was set up for the purpose of showing the pilot the direction in which the boat pointed, to enable him to steer correctly." —DEWEY, JOHN: How we think, pp. 69, 70.

What is meant by " explaining things "?—For everything which he observes, the scientist seeks an explanation.

This we know. But what does seeking an explanation mean? Let us examine instances of this scientific procedure. As I sit at my desk a peculiar odor suddenly attracts my attention and impels me to seek an explanation. I open the door of my study and the odor becomes stronger and is recognized as that of scorching timber. This fully arouses me and I rush into an adjoining room in order to make sure that two gas flames which are there in use are in proper condition. One of them I discover to be turned so high that the wood above it is scorching slowly. This observation relieves my anxiety by giving me knowledge of what I call the cause of the odor. My investigation has resulted in an explanation of the odor experience and I am satisfied because I can now rid myself of it by turning down the flame.

The reader will note that what I have done is to discover certain conditions in connection with which the scorched odor appears. I know from previous experience that such an odor often accompanies the heating of certain objects and I immediately jump to the conclusion that there is a necessary connection between flame, heat, condition of wood, and the odor. Nevertheless, it is important to realize that the scorched odor might have been connected with any one of many other conditions. For example, an experience in my study similar to that I have described might have led me to the discovery that an electric arc lamp on the floor above me had become so hot as to burn the asbestos about it, thus producing a peculiar odor. Evidently there may be several different conditions for the same phenomenon—even for the same quality of odor. A satisfactory explanation of anything can be given only when one knows the conditions thereof. They need not be the necessary and invariable conditions, but they must be real conditions.

Cause and effect.—Science seeks causes. A given fact is observed and the observer immediately asks, What is

the cause of this phenomenon? What he presents as a cause turns out to be just what we have discovered to be a condition of the fact. The cause of the odor of scorching wood is the over-high flame, or the over-heated lamp box. Or again, it may be said to be the condition of the wood or asbestos. Evidently a series of conditions are involved in every causal explanation. Every effect has its cause or causes. This is a scientific postulate. Having made an observation the scientist is certain that further observation will give additional knowledge of the relation of the fact to other facts. But, merely to name one event as the cause of another is not nearly so satisfying as to describe fully and accurately the actual conditions which preceded and accompanied the event which we are interested in understanding. We have valuable knowledge of a phenomenon only when we are familiar with the circumstances in which the phenomenon appears. One, above all the others, of these circumstances may be important at this moment, but in the long run it is desirable for the observer to know the situation in its entirety.

An effect may have more than a single cause.—Our illustration has called to mind the fact that the "scorched" odor need not come from a single set of conditions. There are many conceivable sets of circumstances; many, indeed, which we have experienced, which would give rise to the scorched odor. Given the effect, it is not possible with certainty to describe its circumstances. But given certain circumstances, we may, if we are sufficiently well versed in the knowledge of science, predict a certain effect or series of effects. The value of this evidently rests in the power which it gives us in the control of events. After all, only the scientist is interested in the why of something that has happened. The practical man wishes rather to know how he can make it happen again or prevent its happening. He desires knowledge of the causes of an event

and ability to control them, not merely knowledge that the event is the effect of such and such causes.

Examples of physical causation.—It seems almost superfluous to cite cases of causation in the world of the physical sciences, we are all of us familiar with so many of them. But for purposes of illustration we may examine some one or more of the most commonplace examples of the causal relation of events.

Fire is applied to the powder with which a cannon is charged, there is a flash of light, a rush of air, and a terrific noise, and at the same instant that our ears are almost split by the roar we see a large hole torn in an embankment a hundred yards away. This is a causal series of events. For the fire causes the powder to explode, the exploding in turn causes the flash, the roar, and the propulsion of the cannon ball, and the ball in its turn causes the rent in the earthworks. We may test the relation of the different events as often as we will, if we are careful, and each time the same relations are found to hold. After a time we conclude that the order of events is a necessary order: that the powder can not explode before heat is applied to it; that the break in the earthworks can not occur before the ball has struck it. In a word, that the cause always and necessarily precedes the effect. Note that in all nature, in every kind of science, this observation of the uniformity of relation between certain events gives origin to the notion that one is necessarily the cause or condition of another.

Were the order reversed we should be mightily surprised and there would have to be certain important practical changes in our relations to our world. But the fact is that we have no other warrant for our expectation of uniformity than our previous experience. What we have not seen happen, we do not expect to witness. The causal relation is a great generalization. From the observation, millions

of times repeated, that one event precedes another, we have drawn the conclusion that things must happen thus. This conclusion is valid and serviceable, so long as it is supported by observation, but just so soon as it is contradicted we should revise it. It is rather unfortunate that we should feel toward this particular generalization a sort of reverence. We treat it as though it were Heaven-born, sacred. As a matter of fact, it probably has no greater claim upon validity than have many other generalizations. All are human made and should be held subject to modification.

Last night the water in my aquarium froze. Why? To say that the temperature in the room fell below the freezing point is no comfort to me! I wish to know all the conditions which were contributory to that particular untoward occurrence. For in the future, even when the temperature does fall to the freezing point, I do not wish to have such a result. Indeed, in the past the temperature has many times been lower in the room without the formation of ice in the aquarium. What then is the cause of this new event? Perhaps the current of water through the vessel stopped; perhaps it slowed too much; perhaps the water itself was too cold as it came from the supply tank.

Evidently there is a large number of facts which I should take into account in planning ways of preventing a similar occurrence. Often and often the single fact which we superficial observers name as the cause of an event is not the cause at all. It is merely a possible cause, which, under certain circumstances, might have been the real cause. It is seldom indeed that casual observation enables us to state with certainty that an event is the effect of a particular other event. Causation is not so simple. The causal relation usually involves a lot of phenomena, not two alone.

Explanation is merely an extension of description.— When description has been carried to its limit, there is

nothing more to be said about an object, or event. For the description necessarily includes all the relations of the object to other things, and knowledge of these relations is precisely what the explanations of science offer us. Explanation is, then, only a kind of description, namely, that which presents the conditions contributory to or inseparable from a phenomenon which we are observing. If I would study the exploding of powder, I must have powder to explode and ways of making it explode. I must arrange certain contributory conditions. And every sane person will admit that if my observations are to be long continued it will be necessary for me to know a great deal about these contributory conditions and to pay careful heed to them. The fact is that when one has fully described an event in its setting he has presented the relations so that every observer knows as much about them as he does. Such and such is the order of events—match, explosion, roar, break in wall—but who may say that there is anything sacred in this order. What if a friend should insist that the series of events happened in reverse order! I might hold him mentally unbalanced: I might believe that he is psychologically differently constituted than I. But, in any event, the honest thing—the only scientific thing—for the observer to do is to state the facts just as he observed them, leaving assumption of necessity or of uniformity aside.

To know the how of events is open to us, to know the why is not.—Description seeks to present the how or the manner of occurrence of events. Explanation, as it is usually defined, seeks to state why the occurrence happened as it did. The latter task in any other sense than as a particular extension of description is hopeless. We never discover the why of anything. As little in physics, chemistry, physiology, as in psychology, ethics, or sociology, do we know why an event appears. I can not tell you why a molecule exists, any more than I can tell you why I

experience a sensation of touch at this instant. The molecule and the sensation are alike ultimate facts for me. I may tell you elaborately, and with high exactitude, of the conditions or circumstances under which the one or the other is observed by me, but further I can not go. As little can we scientists explain our own existence as we can explain the universe. We discover day by day more facts and more relations, more about the manner of existence of this and that interesting feature of ourselves and of our surroundings, but of the why of anything, in any other sense than this, we are ignorant.

Nevertheless, science persists in using the term explanation, and properly.—It is worth while to distinguish explanatory description from ordinary simple statement of facts. The former reaches further than the latter. It deals with a wider range of phenomena. It is a special quest. It demands a special interest and attitude on the part of the observer.

In psychology, as in physics, explanations are popular.—The love of the why of things springs not more from curiosity than from the practical significance of ability to control events. Once one knows the why and has learned to control the conditions of an event he is master of his lot. It has been said that one of the chief differences between man and beast lies in the fact that the beast is at the mercy of its environment, whereas man is the master of his. The earth masters the animal; man masters the earth. Rather, we should say man strives for such mastery. Were his goal achieved there would be no suffering, no failures, no death!

There are two ways in which a psychological phenomenon may be explained.—Either in terms of other psychological phenomena, as one should naturally expect that it would be, or in terms of the physical conditions which accompany it. The former type of explanation is

based upon psychical causation; the latter upon the correlation of psychical with physiological phenomena. Both of these ways of explaining mental happenings are, as a fact, now employed, but on the whole the assumption of the existence of causal relations between mental phenomena seems to be unpopular with psychologists. Why this is the case is not easy to understand. Let us examine each of the two possibilities of explaining psychological events.

Psychical causation—the relation of one mental process to another.—It would seem natural that the psychologist should study, first of all, the nature of mental processes and their relations to one another. And further, it would seem inevitable that such an inquiry should yield precisely that kind of knowledge of these events that the procedure of physics, physiology, or anthropology yields concerning the physical events with which these subjects are concerned. Namely, a knowledge of the circumstances or conditions under which a particular phenomenon appears. Why, then, should not this knowledge of mental events be called by the same name as is like knowledge of physical events? Why not speak of psychical causation in precisely the same sense that we now speak of physical causation? For my part, I can discover no valid objection. In either case the knowledge is descriptive in nature and concerns relations of phenomena. But evidently we should inquire as to whether there are differences in the observed relations of psychical and physical events. In the occurrences about us there is an observed regularity of sequence, the roar always follows the explosion. Perhaps in the mental life this is not the case. Possibly psychology has no such observable relations as are used in the physical sciences for the purpose of explanation. This is a question of fact. Let us examine the information at hand, in our search for the answer.

The sequence of mental events and the regularity thereof.—How many hundred times have I observed that a certain visual sensation is followed by certain after-images? Is there not regularity and uniformity in this relation or sequence? May one not expect an after-sensation to follow the sensations of sight, sound, touch, and may he not expect a definite sequence of varying after-images? Given a particular mental content, does one not observe time and time again the appearance of a certain image, idea, thought? There is just as much orderliness in mental events as in physical events, so far as the writer is able to discover. The apparent irregularity in the former, which so strongly impresses most psychologists, is due simply to the fact that we relatively seldom have precisely the same set of circumstances repeated. When the smell of scorching wood has been once experienced in connection with certain other mental processes, it is safe to expect it to be re-experienced when the remainder of the content is represented. One image definitely and persistently leads to another; one idea to another; one sensation to another; a particular sensation is uniformly followed by a particular feeling, emotion, memory. Are not these instances of sequences of events similar to those which give the basis for causal explanation in physics? I think so. Indeed, I am convinced that the first task of the psychologist is *to study the nature of psychical events,* and his second, *to study their relations.* The explanation of one mental process in terms of another is possible. What psychology needs is more extensive and accurate information concerning the sequences of its phenomena. Too long the notion has held sway that psychical events are wayward, uncaused; that we are utterly incapable of discovering their causes; or that their true causes are not other mental events at all but bodily events. This last view—and no other in my opinion has so retarded the development of

real psychological insight and information—we must now consider in some detail.

The explanation of mental processes in terms of bodily processes.—It is an obvious fact that bodily conditions accompany mental processes. The two seem to be interdependent. Ordinarily we are told that a blow on the head modifies or destroys consciousness, that a physical stimulus causes a sensation. We have been brought up to speak of mental processes as though their only important relations are to bodily conditions. This is unfortunate because it leads us to overlook or neglect as unimportant the relations of mental phenomena to one another. Psychical causation, as we investigate it, increases our knowledge of these relations and our appreciation of their significance for a science of mind.

Theories of the relation of mind to body.—There are, as Professor Strong puts it in his interesting discussion "Why the Mind Has a Body," three groups of theories concerning this problem. They are (1) interactionist theories, (2) automatist theories, and (3) parallelist theories.

"Interactionism regards the brain as an instrument employed by the mind in its dealings in the world of objects. It accordingly asserts in causation an action of the body on the mind (stimulus, bodily processes, sensation), in volition an action of the mind on the body (will act, bodily process).

"Automatism conceives the brain process as the physical basis or condition of consciousness. It therefore holds that consciousness merely accompanies the brain-process without exerting any influence upon it." According to the conscious automaton theory of Huxley, consciousness is an effect of certain brain-processes, but it never becomes a cause and in its turn modifies the functioning of the brain.

Parallelism maintains, as, for example, in Professor Clif-

ford's theory, that consciousness and brain-processes flow along side by side without influencing one another.

Professor Strong has most admirably characterized and contrasted these three varieties of theory of the relation of mind to body. "There are thus," he writes, "three distinct theories as to the causal relations between mind and body: interactionism, asserting that the causal influence runs in both directions—in sensation from the body to the mind, in volition from the mind to the body; automatism, maintaining that it runs in one direction only—always from the body to the mind; and parallelism, denying all causal influence and holding the relation to be of a different nature." (Strong, C. M.: Why the Mind Has a Body, pp. 1-3.)

But how is consciousness to be explained?—It is the opinion of the writer that we shall progress most satisfactorily in our study of consciousness if we refuse to tie ourselves to any of these theories, but instead study (1) the facts of consciousness in their mutual relations; (2) the facts of bodily life in their relations; and (3) the correlation of the two series of events. If hypothesis we must have, let it be that each series of events is sufficient unto itself for the purposes of description and explanation. The physicist who wishes to describe or explain lightning, or the physiologist who wishes to describe and explain the beating of the heart, does not appeal to psychology for causes. He finds in the physical series of events those facts which enable him to perfect his accounts of the phenomena. Similarly the psychologist who wishes to describe and explain a perception may find in the events of consciousness the necessary materials for his task. He need not appeal to physics or to physiology for aid.

The proper tasks of the explaining psychologist.—It is the first task of the psychologist to study the structure of mind as if there were no such thing as body. It is his

next task to attempt to explain what he has observed by describing the functional relations of mental processes. He should work, in the main, as though there were nothing in the world except psychic facts. Having learned all that he can about mind, he may profitably seek to correlate mental with bodily processes. *But if with this he begins his psychological career, he is almost certain never to get at the real facts of psychology.* Would it not be deemed absurd for the physiologist to attempt to explain bodily facts, which he only imperfectly knows, by asserting that they are caused by certain mental processes? Surely. Nevertheless, this sometimes has been done in physiology, just as in psychology the reverse has been done. It is commonly said that psychological explanations of physiological facts are a cloak for ignorance. The saying is equally true of physiological explanations of psychological processes.

I am not arguing *against* the study of the relations of the body and mind: I am arguing for the introspective study of mental events in their relations. Body may be caused by mind; mind may be caused by body, or each may be caused in part by the other. But in any event it is the first business of the person who would study either to find out as much as possible about it before he tries to relate it to the other. To correlate physiology and psychology seems to be a most interesting and important task, but it loses its value when it is permitted by the science of psychology to crowd out real psychological explanation, for that really is the extension of psychological description into the realm of relations.

The elementary fact is inexplicable.—In a discussion of his view of psychical causation the writer was asked recently, How do you explain a sensation of red? He replied, I do not explain it, nor do I attempt to explain it, any more than the chemist explains or can explain an atom.

A sensation is just a psychic fact, an atom is similarly a physical fact. Each is useful in enabling us to describe and explain more complex phenomena, but neither can be explained by the science which makes use of it.

The complex object or event may be explained.—The experience of red can not be explained, but the perceptual experience of which it forms a part may be both described and explained. The atom can not be explained, but the chemical substance of which it is a part may be both described and explained. Description demands properties, and explanation demands properties and relations. When I have discovered the exact relations of certain sensations to one another and to certain affections and images, I am able to explain the appearance of a certain perception in my stream of consciousness.

Psychical causation should be studied.—The objection that psychology can not give mental causes for its elemental facts we have seen to apply equally to the physical sciences. It really is not a valid objection.

We should study psychical causation because mental processes really occur in certain definite relations to one another, and because it is through a search for causal explanations that we shall become intimately acquainted with these relations. The popular demand for physiological explanations sidetracks the psychologist and impedes the progress of science.

A warning.—*Almost certainly many readers of this chapter will jump to the conclusion that the writer is not interested in physiology or in physiological psychology and that he therefore underestimates their importance to the general science of psychology. On the contrary, he is keenly interested in everything physiological and, if anything, he is naturally inclined to value the knowledge of the relations of mind to body more highly than purely psychological knowledge as it is yielded by self-observation.*

The point is this: this is a text-book of psychology, not of physiology or of physiological psychology.

CLASS EXERCISE

Self-observation and psycho-analysis. Introspection of associative consciousness under conditions of voluntary inhibition. (The association test.) Materials: Stop watch, or Münsterberg chronoscope;[1] two identical paper or wooden boxes—cigar boxes will do; two objects or groups of objects to be placed in the boxes; a list of forty words, ten of which refer directly to or suggest the contents of the one box, ten the contents of the other box, and the remainder the contents of neither box.

The purpose of the test. (1) To give the student an opportunity to introspect consciousness under the conditions of the voluntary inhibition of an idea; (2) to exhibit the content of consciousness of an individual by recording his associations and association times.

This test may be made in many different ways. Ideas concerning some of these ways may be obtained from the following discussions of the method:

Münsterberg, H.: On the witness stand, p. 82.—Yerkes, R. M., and Berry, C. S.: The association-reaction method of mental diagnosis. *American Journal of Psychology,* vol. 20, pp. 22-37, 1909.—Leach, H. M., and Washburn, M. F.: Some tests by the association-reaction method of mental diagnosis. *American Journal of Psychology,* vol. 21, pp. 162-167, 1910.—Jung, C. G.: The association method. *American Journal of Psychology,* vol. 21, pp. 219-269, 1910.

The conduct of the test. The two boxes, referred to, with their contents properly arranged, should be placed in a room adjoining the class-room. The instructor should explain to the assembled class the nature and purpose of the experiment. He should then select a member of the class to serve as subject for the test. That individual should be asked to go into the adjoining room and carefully examine the contents of one of the boxes, leaving

[1] In the experience of the writer the Münsterberg chronoscope is a very satisfactory instrument for use in this experiment. See Titchener's Experimental Psychology, vol. 2, part 2, pp. 326, 337, for descriptions of various kinds of chronoscopes, among them the Münsterberg instrument.

the other box unopened, and to return to the class-room to be tested by the association method.

Upon the return of the subject, the instructor may proceed with the test as follows: The person to be tested should be seated facing the instructor and should be told to respond to each stimulus word as it is spoken by the instructor by giving as quickly as possible the idea which it calls up, but at the same time to avoid so far as possible giving associations which shall reveal to the instructor knowledge of the box which was examined. The instructor, as he utters a stimulus word, starts the chronoscope and stops it the instant he hears the associated word uttered by the subject. He then records, or has a student record for him, the interval which elapsed between stimulus and response. This is the association time. The test may be greatly facilitated by having members of the class write down the associations as they are given and the reaction times.

At the conclusion of the test, the subject should write a full account of his experiences during the test; the stimulus words, associated words, and reaction times should be written on the blackboard and they should be carefully examined in an attempt to discover whether they give clues as to which box was examined by the subject. After this preliminary study of the results of the test, the reaction times for the ten words which refer to each box and for the twenty words which are not supposed to have special significance should be averaged and the significance of any differences in these averages should be discussed.

The following typical experiment is given as an example of the convenient form which the method may take as well as of the results which it has yielded in the hands of the writer.

In this case one box contained a bottle filled with a white powder and labeled plainly, Strychnine—Poison. The other box contained a time card and a pocketbook with a ticket from Chicago to Ravenswood.

The following table gives the list of forty words, numbers 1 to 40, the associations which were given by the subject who was tested, and the reaction times. The ten words which were intended to suggest the contents of the poison box are preceded by an asterisk; the ten words which had reference to the railway box are followed by an asterisk; the twenty irrelevant words are unmarked. At the end of the table are given the average reaction times and the average variations for the three groups

of words. It is to be noted that the reaction time to the poison-box words is very much longer than those to the other groups of words.

An examination of the associations in this test reveals the following interesting points. The significant word "bottle," to which the association "glass" was given, caused marked delay, and the following word "stricken" so strongly suggested the contents of the poison box that response was inhibited for almost ten seconds. The word anecdote was understood as antidote, thus indicating the presence of the idea of poison in the mind of the subject. The nature of these associations, considered in connection with the reaction times, clearly indicated that the subject had examined the contents of the poison box and was ignorant of the contents of the railway box.

NO. OF WORD	STIMULUS WORD	REACTION WORD	REACTION TIME
1	Book	book	1.90
2	Pansy	flower	2.27
3	Sugar	sweet	1.97
4	Grass	green	1.84
5	Umbrella	rain	1.76
6	Light	dark	1.99
7	Pen (ten)	eleven	1.76
8	* Rat	cat	1.88
9	* Kill	bird	2.46
10	City * (sitting)	standing	4.34
11	Coin *	money	1.89
12	Pillow	willow	3.72
13	Curtain	shade	2.16
14	* Bottle	glass	4.34
15	* Stricken	licken	9.70
16	* White	paint	2.89
17	* Deadly	kill	2.95
18	Hand *	finger	2.59
19	Time *	minute	2.23
20	North *	south	2.96
21	Raven *	black	2.05
22	Garden	flower	2.17
23	Lamp	light	2.09
24	Blue	green	2.25
25	Cloud	sky	3.47

NO. OF WORD	STIMULUS WORD	REACTION WORD	REACTION TIME
26	* Suicide	kill	2.16
27	Rug	carpet	2.51
28	Yellow	blue	1.92
29	Conductor *	motorman	2.86
30	Tar	pitch	2.89
31	* Poise	noise	3.17
32	* Anecdote (antidote)	medicine	3.02
33	Brick	red	2.71
34	Chicago *	city	2.56
35	Public *	private	1.75
36	Ship	boat	2.12
37	Hammock	swing	2.91
38	* Glass	tumbler	1.91
39	Card *	game	2.26
40	Color	blue	2.46

	Irrelevant Words	Poison-box Words	Railway-box Words
Average reaction time..	2.34 ″	3.45 ″	2.55 ″
Average variation......	.40 ″	1.43 ″	0.51 ″

SUPPLEMENTARY READING

Titchener, E. B.: Text-book of psychology, §§ 3, 4, 5, 9.
Strong, C. A.: Why the mind has a body.
Münsterberg, Hugo: Psychology and life, pp. 53-68, 191-195.

CHAPTER XXV

THE EXPLANATION OF MENTAL PHENOMENA: PSYCHICAL CAUSATION

"The physiological psychologist must avoid the error, an error into which too many physiologists have fallen, of neglecting or despising the refinements and subtleties of the introspective psychologists. He must admit the primacy of introspective psychology, must recognize that all the objective methods of psychological study presuppose the results of the subjective or introspective method and can only be fruitful in so far as they are based upon an accurate introspective analysis of mental processes. He must recognize, too, that introspective psychology is in a much more advanced condition than neurology, and that his work must principally consist in the application of the results achieved by the former to the elucidation of the problems of the latter science, and must not regard his work as designed to supplant introspective psychology, but merely as its necessary complement. Nevertheless, he will not scruple to push his physiological explanations of the conditions of mental processes as far as possible, though admitting the hypothetical and speculative character that, in the present very imperfect state of our knowledge of the nervous system, his explanations necessarily have.

"In accordance with these principles the following pages will first describe in general terms the structure of the nervous system and the nature of the nervous processes, and will then attempt to exhibit the correlations, and as far as possible the causal relations, between the nervous functions and the psychical processes as analyzed and described by the introspective psychologists."—McDougall, Wm.: Physiological psychology, pp. 12, 13.

The essence of the causal relation is uniformity of the order of events.—The physical cause always precedes the physical effect. It is this that observation reveals to us. If even once we should discover two happenings which we had previously supposed to be related to one another as cause and effect occurring in reverse order, we should at once conclude that the one event is not necessarily the cause of the other. The fact is that we never observe necessary uniformity.

The important point for present consideration is that of observed sequences of events in consciousness. If the sort of regularity which we discover in the world about us and upon which we have learned to depend in all of the affairs of life, does not exist also in mental life, there is no ground for a science of psychology similar to the science of physiology, no ground for the explanation of consciousness in terms of mental processes, and no ground for the assumption that psychical events may be predicted and controlled as are physical events.

Again, the question is one of fact. Do our mental processes occur haphazard, now in one order, now in another, without uniformity or regularity? Or does that regularity of sequence which forms the observational basis of what we call the causal relationship exist for psychology just as it does for physics or physiology? The material of this chapter, if supplemented by persistent and conscientious introspection, should enable every reader to answer this question to his own satisfaction.

Examples of sequences of events in consciousness.— The stream of consciousness consists of a bewildering complexity of phenomena. It is difficult even to discover all of them, and almost hopeless is the task of working out their complicated relations. Yet, precisely this must be done, at one and another point, if we are to learn with certainty whether psychical events follow one another in orderly fashion instead of unpredictably. It is, of course, conceivable that the order of events in mental life differs radically from that in the physical world. While being regular, and describable in generalizations similar to our physical laws, it may be more complex and at the same time subject to a greater variety of sequences. We should not approach the task of studying the order of mental events with the idea that the only way to establish the existence of a causal relation between mental phenomena

is to prove that the sequences of mental events are precisely like those of bodily events.

To repeat, for emphasis, certain statements of the previous chapter—there is no sequence which enables us to explain an elementary fact of science. We do not explain the products of chemical analysis: the atom, the molecule, the ion, the living cell. These are unexplained. For any physical event or object all that we can give in the way of an explanation is a statement of the conditions which are, so far as we can discover, necessary for its existence. We never give final causes; all are proximate and partial. This is true also of psychology. We can not explain the sensation or affection, or other elementary process. These exist as facts for the science. We all accept them as data with which to work. As little are we able to explain the existence of a physical as of a psychical world. All that we can hope to do is account for certain of the manifestations in these worlds, for certain of their more or less transient phases.

To the question, What is the cause of this sensation of red which I am experiencing? the psychologist must answer, " I no more know than I know the cause of the ultimate products of chemical analysis. All that I can explain is the marvelously intricate and complex mental life which results from the interweaving of sensations and affections and images; of ideas and emotions and thoughts."

Some sequences of sensations.—Certain sensations are uniformly followed by certain others. The primary sensations of color, of light, of sound, of touch, of cold are regularly followed, under fixed conditions, by certain other experiences. (It is to be noted, that fixity or constancy of conditions is as necessary for uniformity of sequence in mental as in physical life.) We call them after-sensations or after-images. There is great variation in the appearance of these images and to the casual observer they seem to

occur quite irregularly, at haphazard, and to conform to no general law. However, the more carefully one studies them the more certain he becomes of a definiteness of sequence in these sense experiences. Indeed, whenever, *and this is the supreme test of the causal relation in any sphere,* I wish to experience an after-image of light or color or sound I voluntarily so arrange things that a sensation of light or color or sound shall appear in consciousness. I may have to try several times before I get the after-sensation in the precise quality, intensity, vividness that I desire, but what additional reason need be asked for this inaccuracy of control than the imperfection of my knowledge of the relations of psychic processes.

The matter deserves a fair test.—Subject yourself to introspection time after time, under external and internal conditions which are as nearly constant as you can make and keep them, and in the light of the results decide for yourself whether there is regularity in the sequence of mental events. For myself, I find a surprising degree of uniformity in the order and time of appearance of certain experiences, when I am sure that the conditions of observation have remained reasonably constant. Too often we forget that external conditions have changed, that the light is no longer the same in intensity, or position, or that new stimuli have appeared, and even more frequently we ignore those internal changes which we roughly indicate by saying that we have become fatigued, that our attention has shifted, that a new feeling has come into consciousness. Myriad are the modifications in consciousness which may alter the sequence of sensations, or of after-sensations.

But let us suppose that conditions are, from observation to observation, kept as nearly constant as is possible to human ingenuity, then what happens time after time when, after looking for fifteen seconds, no more, no less, at an illuminated spot whose color, tint, chroma, and brightness

are precisely the same, I immediately look away to a dark surface? What happens in consciousness? A visual after-image is experienced, and that without fail. May we not reasonably think of the sensation, with its concomitant experiences, as the condition or cause of this after-sensation? Not until we observe the after-sensation preceding instead of following the original sensation, shall we have good reason to believe that this observation does not conform to the requirements of psychological causation.

A typical causal series.—"If at the end of 1 min. the half-black and half-white card (of the adaptation frame

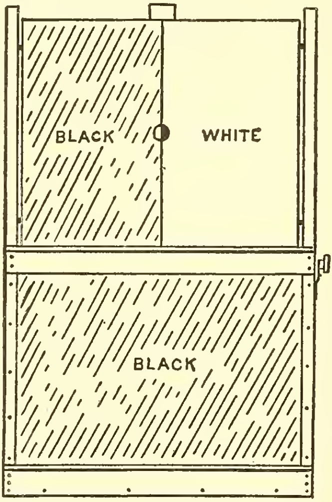

Fig. 10. Adaptation frame. (After Titchener.)

represented by Fig. 10) is allowed to fall, and there is shown in its place a background of uniform gray, the observer (whose gaze has been fixed upon the button at the middle of the line of contact of the white and black fields) will see an intense black where he previously saw

white, and a brilliant white where he previously saw black.'' (Titchener, E. B.: Text-book of Psychology, p. 74.)

This description of a sequence of mental events, which fulfills all of the requirements which we make of causal physical sequences, is quoted from a psychologist who denies the existence of psychical causation, and who claims that our only way to explain mental processes is to refer them to certain correlated bodily (physical) *processes which are not their causes!*

Grounds for denying psychic causation in this case.—It is claimed that the visual after-images are extremely variable and unpredictable and that we may not believe the primary sensation to be the necessary condition of a particular after-sensation. To this we may reply that the first and more important fact is that under definitely describable conditions, an after-sensation regularly follows a primary sensation. This, surely, is a causal sequence. Further, we may reply that if the after-sensation varies in its attributes it must be because of changes in the external or internal conditions. For is it not held by the very psychologists who deny the causal relation to psychic processes that every such event corresponds to certain bodily events? On their own ground they are logically forced to admit that each of the many after-sensations which one may experience after a given primary visual sensation has its own bodily conditions. This, to be sure, is to admit that the conditions of observation have not remained constant.

Psycho-physical parallelism forces the acceptance of psychical causation.

There are definite observable sequences of sensations and these same observed sequences may be used, nay, must be, if psychology is to explain its facts after the manner of the physical sciences.

All that we claim in this connection is that the same bodily conditions are uniformly accompanied by the same mental processes. We are misled into thinking mental events unpredictable, irregular in occurrence and lacking causal relations to one another, because we do not observe the changes which occur in bodily conditions and in mental content from moment to moment.

Sequences of sensations and affections.—Certain sensations are distinguished by the fact that they call up disagreeable affections, feelings, or emotions. We come to dread these sensations because of this fact. Why should we not think of them as the causes of their sequels? A particular odor, not in itself unpleasant, is intensively, vividly, disagreeable to me because it was once in my life associated with a long illness. Have not the odors of iodiform, of ether, or of chloroform feeling-sequels which are as uniformly presented as is the effect of pricking a bubble? The sensation is not the affection, but neither is the affection inseparable from the sensation.

The regular and invariable sequence is sensation, affection.—It is precisely this result of observation within the sphere of my mental life that forces me to believe that psychical phenomena are orderly, and that with further knowledge we shall be in a position to formulate some of the laws of this orderliness, just as we have done in the case of the physical world.

Each sensation of a grown-up human being has certain observable sequels. Sometimes they are prominent, sometimes they are overshadowed by other psychic events. It is only to careful introspection that they are uniformly revealed. The affection is only one of many experiences which is definitely connected for me with the odor of iodiform. For the present, we are interested merely in the occurrence of sequences which may be verified and repeated. The possibility of repetition is important. If I

wish to experience a particular feeling, for introspective purposes, I may seek to do so by gaining a certain sensation. That is, I seek a stimulus for the sensation, trusting that the feeling will appear in due course. Is not the same our procedure in the practical world of physical happenings? Does this not prove that we assume psychical causation in daily life?

Sequences in images.—In the formation of a percept certain psychic elements enter into definitely describable relations of coexistence with certain affections and images. The complex constitutes an experience to which we give the special name percept. Now, in a very important sense the elements which go to make up the percept are causes of the percept; without them and their definiteness of relation the experience could not come into being. The only question is whether they possess uniformity of relation. Any one may settle this for himself by observing carefully the structure of his consciousness of a particular object. A most surprising uniformity is hidden by a superficial variability, to which we are wont to give attention. My perception of the pen with which I write these words I may explain by describing the various sensations, affections, images, and the relations which they must bear to one another if I am to experience the percept.

What is the cause of a psychical compound or complex?—The relating of certain elements of consciousness in definite ways. Precisely the nature of these ways it is the business of the analyzing psychologist to discover. The cause of an idea, a memory experience, an emotion, a thought, a sentiment may be given only by so describing the conditions of its existence that the reasons for its appearance at a certain time are clear.

This is the only strictly psychological explanation of an experience that can be given. It is merely an extension of

description, to be sure, but so likewise are all of the explanations of physical science, for they merely state the conditions of an event.

Sequences of perceptions, ideas, and images in thought.—There are no more striking examples of mental sequences than the associative trains of ideas. Who has not had one idea " call up another " time and again, until it seemed almost as though the one could not be experienced without the other? Is this a causal relation?

The sequence of ideas, as I attempt to recall a face which I saw last week, constantly leads beyond itself. I discover by self-observation that there are psychological reasons (conditions) for the appearance of images, ideas, feelings, thoughts which at first struck me as quite irrelevant and mere chance occurrences.

Take for example the associative train which terminates, as previously described, in my consciousness of the name Rushworth. At least a dozen times the various steps in that associative process have appeared in my consciousness. I have come to regard one idea as the cause of the next. Am I wrong?

Surely it is worth while to observe as carefully as we may the relations of our experiences to one another, as well as to bodily processes.

It is the writer's belief that precisely as certain physical conditions bring about the formation of ice, the vaporization of water, the compression of air, so certain mental conditions bring about the formation of an idea, an emotion, a judgment. When we know the conditions in the one case as in the other, there will no longer be question about the principle of causality in psychology. It is simply our ignorance which makes our mental life seem uncaused and haphazard. Growth of knowledge enables us to formulate laws. The conditions of image formation, I am confident, will not appear to us less definite and regular in their rela-

tion to the experience when we know them intimately than do those of the formation of steam, of ice, of coal.

CLASS EXERCISE

Self-observation. Introspection of associative complexes. The association test continued. Materials: same as for the previous exercise, with the substitution of new contents for the two boxes and a new list of words, or of the description of a series of acts to be carried out by one of the individuals tested.

For the sake of variety, it may prove desirable instead of repeating the association test under conditions similar to those previously used, to attempt to discover which of two individuals has knowledge of certain facts.

This has been done by the writer by selecting two members of the class and sending them out of the room with an envelope containing directions as to certain things which are to be done. One of the students—which one should be decided after they leave the room—is to carry out the directions; the other should know nothing about the contents of the envelope.

The students later return to the class-room, one at a time, to be tested by the association method.

Upon the completion of the test, each student may be called upon to report interesting and important points of introspection, in order that the reaction-time results and the associations may be given introspective significance for the class.

The results of the test may be handed to a member of the class for detailed study and report.

To another member of the class, the task of looking up and reporting briefly on the literature of the association method may profitably be assigned.

SUPPLEMENTARY READING

WUNDT, WM.: Outlines of psychology, § 22.
STOUT, G. F.: Manual of psychology, chapter 3.

CHAPTER XXVI

BODILY AND MENTAL PROCESSES: CORRELATION

"When I endeavored to learn from the literature more precisely how brain anatomy and psychic phenomena are related to one another in the lower animals, I discovered something very surprising. It is true that I found in all the text-books very promising illustrations of the brains of sharks, frogs, rabbits, and other animals, yet I remember as if it were to-day the lively undeception which I experienced when I found that in all the books, even Wundt's great work, the psychological part of the text made no reference to these illustrations. I discovered that psychology had made no further use of comparative anatomy than, so to speak, as a means of illustrating its texts. I gradually discovered the reason for this. In reality anatomy has had nothing to offer to psychology."—Edinger, Ludwig: The relations of comparative anatomy to comparative psychology. *Journal of Comparative Neurology and Psychology*, vol. 18, p. 437. 1908.

"Since consciousness depends upon organic processes in the brain, the sum-total of the changes induced by these processes must form an objective symbol of consciousness. The structure of the brain statically symbolizes in a certain fashion—just as a machine symbolizes an industry—all that may occur in consciousness, the potentiality of the particular psyche, and therefore not only symbolizes the animal's body itself but also whatever is accessible in the external world to the animal and the relationships of action and reaction which theoretically link together the environment and the organism. If our anatomical knowledge was complete we could deduce from the structure of a brain not only the size, form, and the structure of the animal to which it belonged, but also the environment in which the animal lived, its habits, and the activity it was capable of exhibiting.

"There is no doubt that anatomy, aided by what we know of physiology at the present time, defective and disconnected though it may be, can answer at least in a general fashion many problems of this nature. Conversely, where physiological and psychological attitudes are known, the anatomist can account for certain singularities which some species of animals show in their cerebral cortex. Following precisely this parallelism of cerebral anatomy with physiology and the psychology of certain animals, Gall succeeded in establishing the fact that the brain cortex is the particular organ of psychic activity."—Lugaro, Ernesto: Modern problems in psychiatry, chapter 3. "Anatomical Problems," p. 74.

Two forms of an interesting question.—Psychical and physical scientists approach the problem of the relation between mind and body from such different points of view that they formulate the fundamental question quite differently. The psychologist asks, Why has the mind a body? The biologist asks, Why has the body a mind? Each form of the question has been answered tentatively in most diverse ways, but up to the present time no one has presented a solution of the problem which suits both psychologists and biologists. For the students of mental phenomena, consciousness is of prime importance and bodily existence is of secondary interest. In fact, the psychologist studies the body only that he may the better understand the mental life. For the students of biology, physical phenomena are, as a rule, of prime importance and mental phenomena are simply troublesome appearances which demand explanation in terms of bodily processes. The modern biologist studies consciousness only in so far as it aids him in understanding the physical existence of organisms. To be sure there are exceptions on both side. There are psychologists who adopt a point of view which is strictly biological, and there are likewise biologists who grant that mental phenomena are not subordinate to bodily existence.

We shall not seek answers to either of the questions proposed, except in so far as the study of the correlation of mental and bodily processes will serve that end.

The assumptions involved.—The question, Why does the mind have a body? seems to imply that the body is merely a sort of temporary abode of consciousness. And the question, Why does the body have a mind? similarly implies that consciousness is only a transient accompaniment of bodily existence. The first question suggests that bodily happenings should be accounted for in terms of consciousness. The second suggests instead that consciousness

should be explained in bodily terms. Each form of the fundamental query involves an assumption. Many psychologists, either avowedly or in effect, assume that mental processes can not be fully accounted for by biological explanations, and likewise many biologists assume that they can be so accounted for. Now, the point of view from which this book is written makes it quite unnecessary, and undesirable, to accept either of these assumptions. Instead of working on the presupposition that mind causes body, or that body causes mind, we may more profitably admit to ourselves that we do not know whether a causal relation exists between the two sets of phenomena. Thus we should be free to work toward a solution of the problem, without the encumbrance of a philosophical system or of prejudicial assumptions. It is this attitude of interested ignorance that would seem most favorable to the discovery of the real relation between body and mind. It may sometime become indisputably clear that body is merely the shell of mind and that the latter may exist apart from any organism, or it may become as clear that mind is subordinate to body and can not exist apart from it. We should rather seek facts openmindedly than strive to gain support for one or the other of these diverse views.

A substitute for the above assumptions.—Refusing to believe, in the absence of facts, that mind can or can not exist apart from body, we may with profit study the manifestations of bodily and mental life with a view to correlating them. This is the task of explanation through correlation. Certain psychologists claim that it is the only way open for the explanation of psychical phenomena. Each sensation, affection, emotion, thought, they tell us must be explained by being referred to the particular bodily processes which it accompanies. But these same psychologists, for the most part, do not insist that the bodily processes cause the mental events. Instead, they claim that we

do not know the causes of changes in consciousness; that there is no such thing as psychical causality; that the only explanations we have for mental phenomena are their accompanying bodily phenomena. From the previous chapter it is clear that this view is not acceptable to the writer. He prefers, on the basis of introspection as well as logic, to place explanation in terms of psychical causality among the tasks of the psychologist, and to admit, as one of his border-line tasks, connecting physiology and psychology, the study of the correlation of mental processes with bodily processes. This task yields a subject which is recognized as physiological psychology or psycho-physiology, according to the point of view and relative emphasis laid upon one or the other aspect of the phenomena. The psychologist speaks of physiological psychology, and the physiologist of psycho-physiology.

Consciousness is known to us only in connection with bodies.—If any one had succeeded in observing consciousness apart from a living body the position of the science of psychology would be clearly established, for it would be rendered independent of biology, so far as the right to existence is concerned. But no one really has made such an observation, to the satisfaction of scientists. Therefore it is that all natural scientists insist that mental life should be studied in connection with bodily life.

The organism is a whole. It possesses a certain *form*, changing from moment to moment; it exhibits manifold *functions* or activities, it also possesses *experiences*. There are, then, three aspects of a living thing which merit careful study. The first of the general aspects of life is dealt with in the well-developed sciences of structure: gross anatomy, histology, embryology, cytology. The second is dealt with in the newer sciences of function: general physiology, experimental zoölogy, heredity, animal behavior. The third is less satisfactorily dealt with in the psychical sciences:

individual psychology, psycho-genesis, social psychology, psychiatry, sociology.

It is the present mode to regard all of these sciences as strictly biological because they deal with aspects of organisms. It remains, as has already been pointed out early in this text-book, for us to discover whether consciousness is really and necessarily an aspect of bodily existence. Perhaps its independent existence may be demonstrated.

The nature of the task of correlation.—Correlation means for psychology the observation of the bodily conditions which accompany, and apparently condition or cause, a given mental process. It means the study not alone of the changes which occur in the various parts of the body as consciousness changes from moment to moment, but also of the definite changes in the structure of the organism which become more or less well established in connection with certain forms of consciousness.

When I experience a sensation of bitter, what is the condition of my body? Is there anything definitely connected with the mental event? Wherein does the condition differ from that when, instead, I experience a sensation of green? These are typical psycho-physiological questions.

The nervous system and consciousness.—First, in seeking the correlation of body and mind, we are wont to note the parts of the body, or organs, with which consciousness seems to be associated. Of special importance, so far as physiological evidence goes, is the nervous system. Every psychologist, after he has really learned what introspection means and become familiar with the important facts and principles of mental life, should familiarize himself with the structure and functions of the human nervous system: the sense-organs (receptors), the nerves (conductors), the nerve ganglia (centers), and the organs of motion and of secretion (effectors); for only in the light of a thoroughgoing knowledge of these biological facts can correlation

become significant. Let us then turn first to correlations of bodily organs with mental phenomena.

Structures and mental events which do not exist apart, so far as we know.—There are certain commonplaces of observation which come under the head of bodily and mental correlations. Among them are: no eyes, no visual sensations; no ears, no auditory sensations; no nose, no smell sensations. These definite parts of the body to which sensations are referred are called by the psychologist sense organs, and by the physiologist receptors. According to the size or degree of development of a given sense organ, we infer the degree of importance of a certain mode of sensation in the life of an organism. We should, for example, expect the dog, whose sense of smell is highly developed, to have a much larger and more elaborate sense organ of smell than has the pigeon, whose sense of smell is relatively simple and unimportant. And this really is the case. Thus it is true that the psychologist is not infrequently led to assume the presence of certain sensations in the mental life of an animal simply because the animal possesses the particular organ which appears to be responsible for the sensations. To the comparative anatomist a highly developed eye or ear suggests that these organs play an important rôle in the life of the organism; to the psychologist they suggest that the animal experiences a variety of visual and auditory sensations.

It is not alone sense organs which have become signs of mental processes.—The presence and degree of development of various portions of the brain and of other groups of nerve cells have acquired a similar value because of their correlation with certain mental facts.

It is known, for instance, that a large olfactory lobe—that portion of the brain which is most directly connected with the sense organs of smell—is possessed by animals whose sense of smell is unusually keen, and that the con-

verse is true of animals whose smell is poor. Similarly observation has indicated that the presence of the portion of the brain which is called the cerebral cortex is likely to be accompanied by highly complex ideational life, associative processes, and memories. Hence it has become the custom to assume that possession of a cerebral cortex indicates the possession of intelligence.

A sound body implies a sound mind.—It is definitely known that our ability to do a certain thing depends upon the wholeness of certain parts of the body. The destruction of small portions of the brain renders one incapable of moving his finger, hand, right arm, right leg, upper lip, or tongue. Similarly destruction of certain parts of the body disturbs one's consciousness. This or that mode of sensation may drop out of the mental life of the individual, as small parts of the brain are cut away; and the same is true of all mental phenomena. Each particular kind of experience seems to depend upon a certain bodily organ or part thereof. Instances might be multiplied beyond number of just such correlations, which have been discovered by physiologist and psychologist. But the few which have been mentioned will suffice to make clear the essentials of correlation. The student who really wishes to understand the nervous system, or any other portion of the living body, in its connection with consciousness should go to anatomy and physiology for accounts of the structure and functions of the nervous system; to physiological-psychology for an account of the correlations; and to psychology proper for the facts of mental life.

But structures are crude indications of mental processes.—A particular bodily organ may undergo slight changes with which are connected most radical changes in consciousness. For example, although the presence of an eye may indicate that I experience visual sensations, only the nature of the chemical changes in the organ can enable

us so to correlate a sensation of green, or white, or purple with the bodily condition that the kind of sensation may be predicted. Therefore it is that instead of simply observing the presence or absence of a particular organ, in our attempts to correlate bodily with mental processes, we must observe minutely the changes which occur in the organ. The retina, the sensitive portion of the eye, is so influenced by light that it undergoes a great variety of changes. Certain of these changes are associated with color sensations, others with light sensations. Could we observe the retina with sufficient care and accuracy we should be able to say that its condition is such as is accompanied by a sensation of green, or white, or purple. And so it is throughout psycho-physiology. The ideal is to gain that intimacy of acquaintance with the bodily conditions which are present when the individual experiences a certain mental event, that the two may definitely be correlated so that when the one event is observed we may with a high degree of probability expect to be able to observe the other.

The best example of psycho-physical correlation appears in connection with emotions.—The bodily picture of an emotion is something with which we are familiar, and every adult human being has learned with skill to interpret a person's bodily attitude in terms of his emotion. It is just because we have correlated clenched fists, tightly closed teeth and lips, flashing eyes, tense muscles, a flushed face, and a threatening attitude with anger that we assume the presence of the latter experience when we observe the bodily conditions described. As was stated in a previous chapter, we can not say that the bodily state causes the anger, neither can we say that the anger causes the bodily expression. The two sets of events exist in correlation but not necessarily in causal relation. Nevertheless, our inability to discover the causal relation does not render the cor-

relation valueless to science. In practical life we know perfectly well that bodily states serve as signs of mental events and are acted upon just as if they were the mental events. If a man acts as though he were angry, we prepare for his anger. Yet, we should not do this if we did not think him angry! Psycho-physical correlations are of indisputable practical importance. Indeed, apart from the study of the characteristics of mental life and the principles which it exemplifies, there is nothing more interesting or more likely to be of practical importance to the race in connection with psychology than the correlation of bodily with mental phenomena. But one should be an expert psychologist, anatomist, and physiologist before he attempts such correlation.

The great difficulty in correlating body and mind.—There is one serious practical difficulty in the way of psycho-physiology at present. We are not able to observe bodily changes with sufficient exactitude, detail, or thoroughness to enable us to discover correlations that are of real value. There is nothing discouraging in this situation. It is merely the status of our sciences.

If when a sense organ of taste is subjected to the action of a chemical substance which you and I describe as sweet, we could observe minutely the changes which occur in the cell, we should obtain knowledge of the important bodily processes which accompany the sensation of sweetness. But even were our knowledge of the changes in the sense organ perfect, may there not be a multitude of changes in other portions of the body which are as definitely correlated with the sensations as are those in that particular cell? Are there not particular changes in the nerves of taste which connect the cell with the brain, changes also in certain of the cells of the brain itself, and do not these changes appear whenever that particular quality of taste called sweet is present? This suggests how hopelessly vague and

imperfect is our statement that the sensation of sweet is correlated with changes in the body—and especially in the organs of taste and in the temporal lobes of the brain.

It is precisely because of this meagerness and incompleteness of our knowledge of the bodily phenomena which accompany mental phenomena that the writer insists upon the thorough study of consciousness, in an introductory course in psychology, instead of the study of the superficially known connections of mind with body. Just so surely as we permit ourselves at the outset of our study of psychology to turn to psycho-physiology we lose the opportunity of becoming proficient in either field. We should determine to understand both bodily processes and mental processes before we undertake to study their relations.

The importance of correlating bodily and mental processes.—If it is important that we observe phenomena, seek their laws, and strive to explain them from the point of view of the psychical scientist, as well as from the very different point of view of the physical scientist, then, surely, it is also important for us to compare and correlate the results which are obtained by the two groups of sciences.

Throughout this book emphasis has been laid upon the desirability of studying objects of scientific inquiry single mindedly, whole heartedly, and enthusiastically from one point of view. Whether it be the psychical or the physical makes no difference unless perchance one wishes to obtain psychological information, or physical information. The idea underlying this emphasis is that we lose infinitely more than we gain, especially as beginners in psychology, if we attempt to shift frequently from the point of view of the psychologist to that of the physiologist.

It is now in place to insist that the tasks of psychophysiology are quite as interesting, quite as important, and quite as worthy of the scientist's best efforts as are those of either the psychologist or the physiologist, and

that they should not be neglected by the student *who is well grounded in psychology and physiology.*

CLASS EXERCISE

Self-observation. Introspection of the simple reaction consciousness. Materials: a stop watch, or better, a Münsterberg chronoscope; a number of bits of cord, each about six inches long and knotted at each end.

Measurement of simple tactual reaction time. If it is convenient, the members of the class may be arranged in a circle so that each can, with his right hand, touch the shoulder of his neighbor. The instructor, having directed that eyes be closed and that the right hand be placed on the shoulder to be tapped, with the forefinger raised ready for reaction, starts the series of reactions by quickly and lightly tapping the shoulder of the student on his right and at the same instant starting the time-measuring instrument (stop watch or chronoscope). The student, as soon as he feels the tap on his shoulder, lightly taps the shoulder of his neighbor on the right, and so on around the circle. The last student in the circle taps the shoulder of the instructor, who responds by stopping the time-measuring instrument.

The interval recorded, divided by the number of individuals in the group, yields the average simple tactual reaction time. The experiment should be repeated ten or twenty times and the results should then be averaged.

Each student should, at the end of the tests, write an account of the introspections made during the experiment. The following questions should be answered. Did you think of the expected stimulus (tap on the shoulder), or of the movement which you were to make? Which attentive consciousness would enable you to react the more quickly; the more accurately?

Another method of passing along the stimulus may be suggested. Each member of the class may be supplied with a short cord, knotted at both ends. The chain is completed by having the individuals hold an end of one of these cords in each hand. The stimulus is passed along in the following manner. The instant the instructor starts the chronoscope he jerks lightly on the cord in his right hand. The instant the student holding the other end of the cord feels the jerk he similarly jerks on the cord held in his right hand, and so on until the last individual

in the circle is reached. He, instead of pulling a cord with his right hand, touches the hand of the instructor as it rests upon the key of the chronoscope.

SUPPLEMENTARY READING

Judd, C. H.: Psychology, chapters 2 and 3.
McDougall, Wm.: Physiological psychology, chapter 1.
Edinger, L.: The relations of comparative anatomy to comparative psychology. *Journal of Comparative Neurology and Psychology*, vol. 18, pp. 437-467. 1908.
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Sherrington, C. S.: The integrative action of the nervous system.

CHAPTER XXVII

STIMULI, BODILY PROCESSES, AND SENSATIONS

"Receptors which initiate reflex movements advantageous in regard to some locus of the surface of the body itself, e.g., removal of irritation thence, initiate as sense-organs sensations referred to that same locus. Instances might be multiplied, but they have risen prominently in several of the foregoing lectures, and are sufficiently before our minds now. A practical inference from them is that physiology and psychology, instead of prosecuting their studies, as some now recommend, more strictly apart one from another than at present, will find it serviceable for each to give to the results achieved by the other even closer heed than has been customary hitherto.

"Besides this similarity of time-relation and other features between the physiological and psychical signs of neural activity, another link connects the psychological and physiological for the biologist. To the physiology of pure reflexes, that is, reflexes devoid of psychical accompaniment so far as introspection can discover, psychological interest nevertheless attaches, and on a very distinct ground. This ground of connection is seen if inquiry is followed along the animal scale in the direction from higher forms to lower rather than by the usually more favorable reverse approach. This is partly because we directly observe psychical phenomena by introspection only, that is, only in ourselves; and the facts discovered by introspection are applicable to other beings the more readily the more those beings resemble ourselves, namely, are animals ranking near to man."—Sherrington, C. S: The integrative action of the nervous system, pp, 386-387.

Physiological psychology deals with three groups of phenomena.—Observation indicates that sensations are the accompaniments of certain processes in the nervous system, and that these processes are, in their turn, usually the sequels of certain physical phenomena. We have come, therefore, to distinguish three groups or classes of phenomena: (1) physical changes, which serve as stimuli for the organism; (2) physiological processes, which serve as accompaniments of sensations; (3) and psychical processes.

It shall be our task in this chapter to inquire somewhat more carefully than we have done heretofore into the nature and relations of these three classes of events.

The nature of stimuli.—We, as living creatures, exist in a world of forces. About us, and also within us, changes in energy are constantly occurring. One form of energy is transformed into another. Chemical energy produces heat; heat in turn is converted into electricity; electricity becomes mechanical energy, and so on endlessly. The energy about us, in its varied forms, heat, light, electricity, mechanical energy, we speak of as our environment. The energy transformations of the organism—and some, at least, of the same sorts of energy manifest themselves there as in the environment—we speak of as physiological processes. As in the external world, quite apart from living things, according to the assumption of physics, forces are constantly acting and producing changes in the amount and distribution of a given kind of energy, so within the body forces produce similar changes. The environment of a living creature is not something constant, static, fixed as to its characters; it is a group of energies, whose form and distribution is not the same in two successive moments. In the same way the organism itself is constantly undergoing changes. These we recognize as waste and repair, growth and decay, activity and repose. The body continues to be alive only so long as these changes continue in certain definite ways which condition self-maintenance. In death there is a radical change in the nature of the bodily processes and self-repair rapidly ceases.

Definition of stimulus.—In addition to the changes in environment and in the organism which are constantly occurring, there are also to be observed definite relations between the two sets of changes. The changes in environment from time to time influence the processes in the living body. Certain of these environmental changes we call ex-

ternal stimuli, for they serve to produce certain definite changes in the organism the sum of which is known as stimulation. *Stimuli are physical events which cause or condition certain other physical events called the physiological processes of stimulation.* For example, a quantity of energy in the form of heat comes into relation to the skin of the hand. It acts upon certain organs of the hand —the receptors or sense-organs of warmth—and in them there occurs a production or transformation of energy which in turn causes a more or less extensive change in the form and distribution of energy throughout the body. From the sense-organ, or organs, of the skin a nerve impulse, whose energetic nature is certain, although we are uncertain as to the exact nature of the energy, passes over the nerves to the spinal cord or to the brain. There further changes occur by the transformation of the energy into yet another form or by the initiation of a new series of events which leads to movements of the organism. The train of events between the application of heat and the withdrawal of the hand may be long and complicated. It is impossible for the physicist, the physiologist, or the psychologist to describe it completely. But we know that it is a train of energetic physical and physiological[1] phenomena and that it therefore is material for physical and physiological study. With these events as such, the psychologist has nothing to do. He attends to them only when he undertakes to correlate them with the psychical events which are said to be conditioned by or to accompany them.

The organism is not sensitive to all forms of energy.— There are many forms of energy making up the organism's environment, but any given organism or type of organism is stimulated by only a few forms and amounts of energy.

[1] It is safer, perhaps, not to assume that all bodily processes (physiological events) are similar to physical processes. Therefore the expression physiological energetic phenomena.

Certain human beings are sensitive to sound, heat, cold, light, chemical action of a number of kinds, electricity, pressure, but their range of sensitiveness is no indication of the forms or amounts of energy to which other animals are sensitive. The ant is said to be affected by ultra violet light—we are not; the mouse is said to respond to tones which are inaudible to us. Illustrations might be multiplied to prove that forms and ranges of stimulation which noticeably affect you or me do not affect certain other men or animals; and that, on the contrary, things which do not affect us affect them. A stimulus is, then, a form of energy which in certain amounts is capable of bringing about a certain change (physiological processes) in a living being. What may be a stimulus for one creature may not be for another, and what may stimulate an animal to-day may not next year. The relation of the body to stimuli changes. At birth we are insensitive to forms and amounts of energy to which we are keenly sensitive later in life. In old age we are insensitive to forms and amounts of energy which affected us markedly during earlier life. The dog detects odors which are quite beyond our ken. They simply do not exist for us. The same world (environment) may furnish thousands of stimuli to one type of organism and only a score or so to another. Indeed no two human beings live in precisely the same world of stimuli.

Forms of energy which affect normal human beings.—There are several varieties of energy which in appropriate amounts act as stimuli for most of us. The best known are the following: (1) Mechanical energy (motion of ponderable objects, contact, touch, pressure). (2) Chemical energy (chemical action). Certain forms of this energy affect our nasal organs, others our organs of taste. Unlike certain fishes, we lack chemical sensitiveness in the skin. We can neither taste nor smell a substance which is placed upon the surface of the body, but certain fishes apparently can do

so. Acid burns the skin and certain other chemical substances affect any portion of the body to which they are applied, but they do not produce effects similar to those of true gustatory or olfactory stimuli. (3) Thermal energy (cold, warmth). When the body, or part of it, is exposed to a condition of temperature which is much higher or lower than that of the body itself, stimulation occurs. Being exposed to the radiant energy of the sun is not essentially different in effect upon the temperature organs from coming into contact with an object whose temperature is higher than that of the body. Each condition produces stimulation. (4) Photic energy (light). This form of energy affects chiefly our eyes. In the absence of these organs we are said to be blind. The frog, however, and the toad, are known to be stimulated markedly by light, even when they have no eyes. Their skin is sensitive to light, as the skin of some fishes is sensitive to chemical action. (5) Electrical energy (magnetic disturbances, electric currents). Although we have no special sense organs for electricity, we are markedly affected by various manifestations of this form of energy. Electric shocks are the dread of many human beings, and to all organisms powerful shocks are dangerous. The whole body is set a-tingling by a weak induction shock. It has even been suspected, by certain students of physiology, that some animals are guided in their migrations by electrical variations in the earth or in the atmosphere. It may readily be believed that some other creatures are much more sensitive to manifestations of electrical energy than are human beings.

Sensitiveness determines one's world.—Evidently the nature of an organism's environment depends upon sensitiveness. If we are not affected by photic energy (light), we live in a dark world. If we are not affected by certain air vibrations, we live in a silent world. If we are not affected by certain forms of chemical energy which are

called gustatory and olfactory stimuli, we live in an odorless and tasteless world. If we are not affected by mechanical energy, we live in an imponderable world. But most peculiar of all is that relation of organism to environment in which no form or amount of stimulation induces the sensation of pain. Human pin cushions are perennial wonders, for they claim that physical events which in you and me would be accompanied by intense pain do not in the least disturb them.

Links in the psycho-physiological chain.—Stimulus, physiological process, sensation—these are events which the scientist seeks to correlate. Intimately concerned with these events are those bodily organs which neurologists have termed receptors, conductors, centers, and effectors.

Sense organs are called receptors because they are especially adapted for the reception of those physical events which act as stimuli to the organism.

The nerves which conduct impulses from or to receptors are called conductors because they obviously serve as means of communication between the receptors and other parts of the body.

The muscles and glands, to which many of the nerves lead, are called effectors because upon receiving a nerve impulse they bring about (*effect*) some bodily change: motor adjustment or secretion.

Certain portions of the nervous system, which stand as stations between receptors and effectors and to which the conductors from both of these sets of organs lead, are called centers.

The diagram of Fig. 11 represents these several important portions of the sensation-reaction mechanism of the human body.

What bodily processes are necessary for sensation?—Processes in the sense organs, in the conductors, and in the effectors may occur without the appearance of a sensation

at the introspective level. This indeed is true of many reflexes. Stimuli are received by certain receptors; impulses are carried to certain effectors by the appropriate conductors, and a reaction takes place, in the absence of sensation. A number of our receptors, for example the organs of the canals and sacs of the ear, are now thought

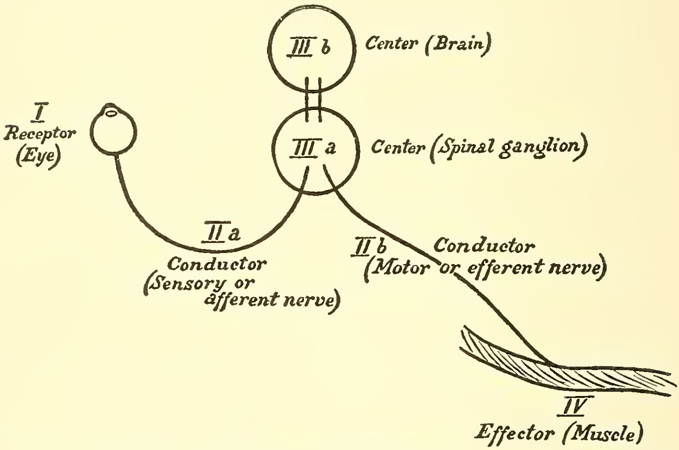

FIG. 11. Diagram of the sensory-motor mechanism of the nervous system.

to be organs which control reactions, without having any corresponding sensations.

It is probable, however, that all receptors exercise control over bodily reactions and possess modes of sensation. In some instances the sensations are readily observed; in others they are difficult to observe, and in still others they have not been observed at all.

But, in any event, it seems clear that no sensation is experienced in connection with a stimulus unless a center in the brain is brought into function. " No brain, no sensations; no brain, no consciousness " are statements which one frequently hears. They are based upon the observation

that *centers* are always in action when consciousness is observable. This observation alone fully justifies the attempts of physiological psychologists to study the physiological processes of the nervous system in connection with the facts of experience.

Relation of sense organ to mode or quality of sensation.—To each type of sense organ a certain mode of sensation corresponds. Thus the retina, whether it be stimulated by light, heat, pressure, or electricity yields sensations of color or light. The ear (cochlea), no matter how stimulated, yields sensations of sound. It is quite impossible for us to alter this relation. We can not get into the way of hearing a tone instead of seeing a light every time the eye is stimulated, although we may experience the former quite often in connection with the latter sensation.

Sensations correspond to stimuli.—It is a commonplace observation that every variety of sensation corresponds to or accompanies the appearance of a stimulus. The same sensation does not necessarily appear always in connection with a given stimulus; for their relation depends upon the nature of the sense organ upon which the stimulus acts. Apparently one might formulate the law, "the same stimulus acting at intervals upon the same sense organ yields the same quality of sensation." But the generalization is not correct for the simple reason that the *center*, as well as the sense-organ and stimulus, must be considered.

Physical processes acting as stimuli produce trains of physiological processes and in connection with certain of the latter we experience sensations. It is not necessary, in the interests of our study of psychology, that we assume the sensations to be caused by the physiological processes, but it certainly is legitimate to work on the basis of that assumption, if one so desires.

CLASS EXERCISE

Self-observation. Introspection of discrimination consciousness in the reaction-time test. Materials: Same as for the preceding exercise.

This exercise should serve (1) to furnish each student with excellent conditions for the introspective examination of discrimination consciousness, and (2) to provide measurements of the discrimination reaction time, which may be compared with those previously obtained for association reaction times and simple tactual reaction times.

Method: With the class arranged in a circle, as in the preceding exercise, and with all conditions the same, the instructor should ask that two intensities of pressure be discriminated: the one heavy, the other light.

In preparation for the tests, the class may practice the discrimination of these two tactual stimuli. After skill has been acquired in the transmission of a stimulus around the circle without change in its intensity, the tests may be begun.

The instructor directs the members of the class to pass along the intensity—weak or strong—of pressure which is received. He then starts the experiment by lightly tapping the shoulder of the student on his right. If the stimulus returns to him as weak he assumes, unless some member of the class makes a statement to the contrary, that it was recognized and properly transmitted by each member of the circle. If, instead, it returns to him as strong he knows that some one has failed to discriminate properly.

After ten, twenty, or, if time permits, more reactions have been recorded for the group in the case of both weak and strong pressures, the results may be placed on the blackboard, the averages and variations obtained, and the results discussed. Or, the recorded measurements may be handed to a member of the class for study, in connection with the reading of the following literature of reaction time, and report to the class:

Jastrow, J.: The time-relations of mental phenomena, 60 pp. (Bibliography to 1890); Titchener, E. B.: Text-book of psychology, §§ 121-123; James, Wm.: Principles of psychology, vol. 1, chapter 3.

SUPPLEMENTARY READING

Ziehen, Th.: Introduction to physiological psychology, chapters 2 and 3.
Wundt, Wm.: Physiological psychology, vol. 1, chapters 3 and 6.
Wundt, Wm.: Outlines of psychology, §7.
Martin, H. N.: The human body, chapters 30-34.

CHAPTER XXVIII

PHYSICAL CONDITIONS, BODILY PROCESSES, AND AFFECTIONS

"The brain stimulation which is caused by the moon is then not conceived as a cause for the perception of the moon any more than the perceived object itself was conceived as the cause. The moon is the cause of the brain action, but not of the idea. . . . This brain excitement, also, is then in no way the cause of the idea and the idea in no way the effect of the brain action; even the usual metaphors which say that it is the inside of the brain process, or that it is parallel to the brain process, or that they belong together as do a concave and a convex surface, are merely practically useful expressions for a relation of a strictly logical character which is derived from epistemological identity. The psycho-physical parallelism of brain function and idea does not, therefore, seek at all to explain the idea by the physiological process, or vice versa, but merely to state that they necessarily belong together, and thus to admit the further consequence that whenever the physical process is causally produced the parallel psychical idea must be conceived as existing. Causality thus connects only the physical objects directly, while the psychical ideas are indirectly linked as accompaniments of the physiological processes. We have seen that such a physical causal connection is in principle a connection of absolute necessity, not comparable with the combination suggested by an observed regularity. So far, then, as the ideas can be understood as counterparts of physiological processes which are causally connected, this convincing necessity binds them, while as merely psychical facts they were disconnected members."—Münsterberg, Hugo: Psychology and life, pp. 64, 65.

Again three classes of events appear.—Although for the physical phenomena which are often spoken of as conditions of affection we have no special name—such as stimuli in the case of sensation—the phenomena nevertheless exist and are studied in physiological psychology. Without attempting to smooth down this description by coining a new term, we may examine the physical events which cause those

bodily processes whose most noteworthy accompaniment is affection.

Nature of the physical events which condition affections.—Any and every aspect or factor of environment which acts upon the organism may under certain circumstances be correlated with affective consciousness. There are not, as for sensation, a variety of physical conditions each of which affects most markedly some limited region of the body and thus produces a definitely localized effect, but instead every condition influences the organism as a whole, or in general, according to its quality and intensity. This influence differs in degree, not in kind, so far as we know, for the many factors of environment. Beginning with weak light, as the factor which is acting upon the body, we note that it produces bodily conditions whose obvious accompaniment is agreeable affective consciousness. If now the intensity of the light be doubled, the bodily processes may radically change and their characteristic accompaniment may be disagreeable affections.

Both environment and organism are changing.—The study of affection in its relations to physical events brings out clearly the fact that physiological psychology or psychophysiology studies the organism in its active and ever changing relations to a varying environment. Neither the one nor the other is static, both change rapidly and constantly. The task of correlation is twofold, for we have first to study physical or environmental facts in their relations to bodily facts, and then these same bodily facts in their relations to mental facts. The first task is primarily physiological or physical, if you like; the second is primarily psychological, or physiological. The goal of each is an understanding of the organism as a self-conscious, self-regulating mechanism, which so behaves as to become more and more satisfactorily adapted to those conditions.

The classes of physical conditions.—The above state-

ment is perhaps misleading in that it is quite possible to classify the chief aspects or factors of environment as pleasant and unpleasant. There are certain conditions which regularly produce or cause those bodily states which accompany disagreeable affections, and there are others which as regularly produce the states which accompany agreeable affections. It might fairly be urged, therefore, that just as there are two chief classes of affections, so there are two classes of physical conditions of affections. But this classification is unsatisfactory for the simple reason that we discover certain factors to condition now one and now the other sort of affection. Perhaps the most direct way to state the facts is to say that there are two classes of bodily states: the one conditioning agreeable affections and the other disagreeable affections. Each of these kinds of bodily condition is determined either by the quality, or the intensity, or both, of the physical condition.

There are certain factors or features of environment which never influence us to the point of agreeableness. The odor of carrion, as soon as it is perceived as such, is disagreeable. In lower intensities it may be agreeable, but it is not then carrion. So even in its highest intensities the taste of sugar may be agreeable. In other words, the feeling tone which accompanies a given quality of sensation may always be agreeable or disagreeable or it may shift from one to the other with change in the intensity of the sensation. This complicates the facts of affective consciousness and increases many fold the difficulties of the task of correlating them with bodily processes, and those in turn with environmental events.

The nature of the three classes of physical facts which are related to affections.—The three classes of environmental counterparts of affections may be designated as (1) the favorable, (2) the unfavorable, (3) the variable. Conditions whose effects upon the body are such that agreeable

affections come into prominence belong in the first class. There are many of them. Under no ordinary circumstances do they produce the bodily accompaniments of disagreeable affections. Conditions whose bodily effects are always accompanied by disagreeable affections constitute the second class. There are relatively few of these in comparison with the number in class one. Certain sounds —rasping, scraping, scratching—seem to have this character for me. The physical conditions which influence my body are uniformly accompanied by disagreeable affections, no matter what the intensity of the stimulus.

Examples might be drawn from every sense field. Certain colors, odors, tastes, contacts, or textures are always disagreeable to some persons. Peculiarly striking examples of these psycho-physical correlations are furnished by certain animals. Spiders and many other animals uniformly come forth as if to seek certain tones, while they as regularly avoid certain others. The guinea pig always behaves as though it were startled and distressed when metallic sounds are produced. The house dog howls miserably when certain tones or combinations thereof are produced. The young chick and the mouse and rat are markedly disturbed by certain shrill sounds. All of these organisms give us excellent physiological evidence of being disagreeably, or agreeably, affected by certain physical conditions.

Who of us has not familiarity with one or another environmental condition or situation which he dreads, not because it produces any violently dangerous or even harmful effects upon the body, but simply because of its disagreeable affective accompaniment? One may strongly dislike to talk with a person who has certain mannerisms. Or one may acquire an antipathy to a person simply because the noise which he makes in eating affects one unpleasantly.

On the other hand, it is true that physical conditions,

which, like most situations, do not appeal especially to any one sense organ, produce now the bodily conditions of agreeableness, now those of disagreeableness, merely by reason of their intensity or vividness. This, *the variable,* would appear to be the largest class of physical conditions of affections. It is the inclusiveness of this class which has given rise to the common, but erroneous, impression that all conditions in our environment tend to act upon us now agreeably, now disagreeably.

Explanations of why one kind of factor should bring about the bodily conditions of disagreeableness and another those of agreeableness.—Apparently we have to search far in the history of the organism to discover the reasons for the causal relations between physical changes and the bodily changes which accompany affections. Natural or expected they are not. Why that simple factor of environment, red light, should stir many animals to most violent activity and in many instances to excitement or rage, is not clear. There is something peculiar about this effect. A condition which one might expect to be agreeable in certain, if not all, of its intensities, turns out to be productive, in many animals, of bodily conditions which in us are accompaniments of disagreeable affective experiences.

Such relations between environment and organism as the above can be understood only in the light of evolution. Present conditions do not enable us to understand them. It would be simple enough could we say, as certain physiologists and psychologists have said, that all situations are capable of producing either the bodily conditions of agreeableness or those of disagreeableness merely through variation of their intensity. The defect in this statement is precisely that of most simple statements in connection with science, it is too simple to express the truth. The facts are complex and intricately related. Intensity alone does not determine the effect of a situation on

the organism. The body is so organized, by reason of the previous action of the condition, that it responds in a particular way—and often in a way which we should least expect. Perhaps the present effect of red upon the body of the frog, the bull, or the turkey is due chiefly to the value which this particular factor of enviroment had for the remote ancestors of those animals. At one time it may have been positively unfavorable, or indicative of the unfavorable, and it still retains the same reactive value for the animals although it is no longer unfavorable to life. There are many useless reactions in the organism, just as there are many useless organs (vestigial). The appendix and the pineal gland, for example, are mere survivals. They have outlived their usefulness, but they continue to exist. So also bodily effects, advantageously produced by certain stimuli or situations in the past, continue to be produced by the same conditions although they are no longer of value to us. Many of our peculiarities of action and feeling are probably to be accounted for in this way. Our antipathies, prejudices, whims are often the psychic accompaniments of *inherited* tendencies of reaction which have lost their reasons for existence.

It is commonly stated that environmental conditions which are unfavorable to life produce those bodily processes whose regular accompaniment is disagreeable affections; and that environmental conditions which are, on the contrary, favorable to life produce bodily processes whose accompaniment is agreeable affections. These statements are extremely indefinite in meaning, however, and they are of relatively little value to us until we have defined the phrases "favorable to life" and "unfavorable to life"; for what is favorable to the life of the race may be unfavorable to the life of the individual and that which appears to favor the individual's life may prove to be unfavorable for the life of the species.

Taking into account these facts, we may say that physical conditions which tend in the long run to diminish the vitality of the organism produce the bodily accompaniments of disagreeableness, whereas those which generally tend to enhance or maintain the vitality of the organism produce the bodily accompaniments of agreeableness.

The why of this correlation is not known, but the guess may be risked that any other relation between environmental and bodily processes would result in the destruction of organisms. In fact the establishment of this relation seems to be the fundamental thing in organic adaptation.

Nature of the bodily conditions of agreeable affections.—Physiology reveals the fact that agreeable affections as a rule accompany anabolic bodily conditions. We express this crudely and imperfectly by saying that anything which stirs us up, without in any sense doing harm to our bodies, is agreeable. Many bodily conditions which are uniformly accompanied by agreeable affections use up energy, fatigue us, cause loss of vitality for the moment, but unless these changes are such as to increase the normal processes of the self-sustaining organism they are not agreeable. To the healthy, vigorous organism anything which heightens vitality is agreeable. It must stimulate; it must not depress. It is a mistake to suppose that the bodily processes which are accompanied by agreeable affections do not involve destruction of bodily substance and dissipation of bodily energy. The height of agreeableness is reached when this destruction reaches its maximum and is yet fully compensated by increase in the reparative processes of the body. It is when the repair (anabolic processes) falls behind the waste (katabolic processes) or destruction that agreeableness changes to disagreeableness.

Nature of the bodily conditions of disagreeable affections.—They are the depleting changes, leaving the organ-

ism weaker by reason of its activity, instead of stronger. They mark diminution of vitality and energy instead of increase, or at least an attempt on the part of the organism at the maintenance of a balance. Any condition which, like strong chemical, electrical, thermal, or photic stimuli, tends to destroy the parts of the body or to interfere with their normal processes of conduction, expansion, secretion, absorption, or excretion is accompanied by disagreeableness. Anything that lessens the secretion of the salivary glands, the pancreas, the liver, the kidneys, soon brings about conditions whose accompaniment is disagreeableness of affection. These same conditions to be sure may tend to stimulate to greater activity the parts affected, but the fact remains that so long as function fails of its normal level, we continue to "feel badly" or to "feel uncomfortable." Agreeableness is usually taken as a subjective index of health; disagreeableness of the lack of it.

Instances of conditions which illustrate these statements.—Let us suppose that a warm metal rod is applied to the skin of the palm of the hand. It produces certain changes in the cells of the region with which it comes in contact, and some of these changes in turn bring about others until a considerable portion of the body is affected. The consciousness accompanying this arousal of certain favorable activities in the body is predominantly agreeable. Now let us suppose the temperature of the rod to be rapidly increased until it begins to cause the protoplasm of the cells of the hand to coagulate. This change, too, gets itself transmitted to other portions of the body. It stimulates the organism as a whole, but at the same time it robs it of energy and rapidly enfeebles it. The accompanying affection is decidedly disagreeable.

Wherever positively destructive changes occur in the organism their accompaniment in the moral being is disagreeableness. There are noteworthy exceptions to

this rule in the case of abnormal or pathological organisms, but those lie beyond the range of our present inquiry.

If the thermal stimulus be still further increased in intensity and brought into contact with other regions of the body, its bodily effects spread correspondingly and the disagreeable affections intensify and tend more and more to monopolize consciousness. Finally, bodily conditions may be produced which are correlated with the total disappearance of introspective consciousness. Physiologically this is the condition of extreme shock. In a word we may, by increasing the strength of a simple stimulus, pass from bodily conditions which are usually accompanied by agreeable affections to those which are as regularly accompanied by disagreeable affections, and thence to the total disappearance of introspective consciousness. Under physical conditions which are extremely unfavorable to life we faint. This is an interesting observation. There are intensities of consciousness, indicated by bodily conditions, which we can not introspect.

But to return to our earlier illustrations, why is a particular color, sound, or odor disagreeable? Surely it does not depress the organism by diminishing the vital processes. Why not, we may ask? The probability is that it does and that could we observe directly the influence of any disagreeable stimulus upon the organism we should discover that it acts much as do over-strong stimuli. It is not necessary that a stimulus or other condition which is to produce disagreeable bodily conditions should do so merely by virtue of its capacity for the destruction of bodily substance or the dissipation of energy. The color red may over-stimulate, it is true, but it may do so indirectly instead of directly as does the hot rod. It may bring about changes in the nervous system which deplete; it may drain the body of its energy of reaction. It may

over-stimulate the brain itself, rather than the mechanism of response.

Why theorize instead of seeking facts?—But what do we know of all this? What is the use in discussing the bodily processes in their relations to affections, or sensations, or thoughts when we do not know intimately the nature of these bodily processes? Would it not be wiser for us to concentrate upon the study of the *facts* of physics, physiology, and psychology until our knowledge is ample for the purposes of correlation, instead of attempting to make the correlations in our present state of relative ignorance? The writer is strongly inclined to reply affirmatively.

Things we should know about the physiological processes in the body.—It is by no means enough to know that the organism moves toward or away from a stimulus in order to be able to decide whether its consciousness is agreeable or disagreeable. Seeking reactions, which have often been characterized as agreeable, may or may not be such. Avoiding reactions may not be disagreeable. For often we note that under violent stimulation the organism rushes upon the stimulus. Of the disagreeableness of the stimuli which cause the assaults there can be little doubt. The insect flies toward the light, and it may continue its course even till death from over-stimulation.

We should know not only the superficial facts of bodily condition—respiration, pulse, blood pressure, temperature, muscle tension, glandular action, etc.—but we should know also the less obvious processes which occur in connection with each of these extensive changes. A particular rate, form, and strength of pulse can be understood only when one knows intimately the physiological conditions of the particular circulatory activity. We should, when a stimulus is applied to the body, be able to describe with accurate detail what happens in the cells upon which the stimulus directly or indirectly acts; what happens in the cell proc-

esses which we call the conductors of the nerve impulse that emerge from the receptor; what happens in the nerve ganglion to which the impulse travels; what happens in the conductors which next come into action; what happens in the effectors. This knowledge would involve a searching study of the changes which occur from instant to instant in the living cell in its vital functional relations to the other cells of the body. Not until we possess accurate knowledge of these, and similar facts, can we reasonably hope to correlate bodily processes with mental processes in a profitable way. Such vague, general, and probably inaccurate statements as those which are made in almost all text-books which deal with this subject—and this book is not an exception!—are valuable only as emphasizing our crying need of facts in physiological psychology.

The value of the two general criteria of affective consciousness.—There are two generalizations with regard to affection which deserve to be restated here. They are first, the statement that agreeable affections accompany anabolic or generally constructive bodily changes, whereas disagreeable affections accompany katabolic or generally destructive processes; and second, that agreeable affections accompany positive or seeking reactions—the reaching out of the organism for more of the physical condition of the bodily state—and that disagreeable affections accompany negative or avoiding reactions—the withdrawing of the organism from the physical condition of the bodily state.

In the preceding paragraphs it has been stated that neither of these generalizations is wholly trustworthy. The probability is that we shall have to modify both considerably before we shall be able to claim great value for them. It should not be necessary to insist that these modifications must be made in the light of ascertained facts concerning bodily processes, not on the basis of hypotheses. It is well enough to conclude that since agreeableness often

accompanies positive reactions, the conditions of these reactions are also the conditions of agreeableness, but exceptions which have been observed render this far from satisfactory proof of the correctness of the generalization. Similarly, it is worth while to question the value of the generalization that whenever the body is stimulated to greater activity by its environment there is agreeableness of feeling, and whenever it is stimulated to lessened activity there is disagreeableness Doubtless each of these statements possesses its grain of truth. But what importance are we to attribute to the exceptions?

The bodily accompaniments of complex affections are by no means so get-at-able as those of elemental affections.—In the bodily expressions of the emotions, sentiments, and feelings we find extreme complexity. It is difficult at times to discover whether the general activity or vitality of the organism is increased or diminished. Yet, on the whole, the impression which one gets from careful observation of his own experience is fairly convincing. How often have we noticed the exhilaration of a joyous emotion and the push which it gives us. Because of a letter which this morning brought me news of an unexpected form of scientific recognition, my whole body seems more fully alive and throughout the day I have worked with unusual vigor and effectiveness. The emotion certainly accompanied a heightened vitality and the effects of this were continued and far-reaching. The rôle of the seeking reaction in this instance is obvious, for did I not read and reread the letter, whereas I hastily put aside the news of a distressing accident. Only the rather morbid person persistently seeks the physical conditions of disagreeableness.

CLASS EXERCISE

Observation. The study of the eyes in their relation to facial expression.

After carefully and repeatedly observing the condition of the eyes of a friend (or your own in a mirror) during different experiences, answer the following questions as fully and accurately as you can.

1. Are the eyes important in facial expressions?

2. Do they change (a) in color, (b) in size, (c) in shape, (d) in position, (e) in size of pupil, (f) in relation to one another, during changes in consciousness?

Why do we describe eyes as "hard," "glassy," "cold," "soft," "gentle," "sympathetic"? If these adjectives are applicable to the same eye at different times, what changes occur so to modify its appearance?

Are mouth and nose, lips and eyebrows more or less important in the facial expression of (a) fear, (b) anger, (c) sorrow, and (d) joy than the eyes?

The observations for this exercise may best be made out of class. The group may discuss the general subject, and some member of the class may make a special study of the results submitted by the class, and of the literature on facial expression, and report to the group.

SUPPLEMENTARY READING

James, Wm.: Principles of psychology, vol. 2, chapter 25.
Myers, C. S.: Text-book of experimental psychology, chapter 25.
Royce, Josiah: Outlines of psychology, chapters 7 and 14.
Judd, C. H.: Psychology, chapter 7.

CHAPTER XXIX

BEHAVIOR AND CONSCIOUSNESS

"Nothing is more characteristic of the young of intelligent animals than the variety and persistency of their behavior, their sensitiveness to stimuli of many different kinds, their restlessness of swiftly changing attention and repose, with occasional pauses of continued effort in some special direction. Constantly on the alert, they exhibit in all its shifting phases behavior which we interpret as indicating curiosity, inquisitiveness, love of mischief, destructiveness, and so forth. The facts are so familiar to every observer of young animals that it is unnecessary to give any detailed illustration. Watch a kitten in this stage of its development and carefully note its behavior during half an hour; the variety of effort, the rôles played by trial, failure, and success, the gain of skill and control over behavior, will at once be evident. Or devote an equal space of time to observing young jays, magpies, or jackdaws. Every projecting piece of wire or bit of wood in their cage is pulled at this way and that way, from above, from below, from the side. Now one, then another, loose object is picked up and dropped, turned over, carried about, pulled at, hammered at, stuffed into this corner and into that, and experimented with in all possible ways. . . . But in young animals such play is, after all, the serious business of their time of life. Its import for their future welfare can scarcely be overestimated.

"And its import is in large degree psychological. If we watch a young puppy or kitten learning gradually to deal effectively with some difficulty in its extending environment, we see that it puts forth its efforts at first in a somewhat random and indefinite fashion. It is one of those animals in which intelligence has been evolved to supersede and become the more plastic substitute for instinct. The random and indefinite movements, are in detail reflex responses to stimuli. But whereas, in a piece of highly elaborated instinctive behavior, such reflexes are grouped into a whole which is coördinate through inherited nervous mechanism, in the case of the acts of the puppy or kitten they have to be further coördinated, or more elaborately grouped, through experience. To act in one way some of the reflexes have to be checked as redundant and not to the point; to act in another way other reflexes have to be similarly checked; and in a third way, yet others. But in all three some of the reflexes are utilized to different ends. Many conscious situations contain common elements; and this tends to give unity to the developing experience. But they contain also elements and group-

ings which afford that diversity without which conscious behavior could not be accommodated to them."—MORGAN, C. LLOYD, Animal behavior, pp. 251-253.

Signs of consciousness.—In daily life we have come to judge of a being's consciousness by its appearance and behavior. In the measure in which it resembles us in form we imagine it to resemble us also in experience. In the measure, likewise, in which its acts resemble ours, we imagine its feelings to resemble ours. These two classes of inferences concerning consciousness are based upon correlations of consciousness with the structure of the body and with behavior. In this chapter we shall concern ourselves wholly with what living creatures do and with the relation of their activity to consciousness.

Both structure and behavior are used as signs of consciousness.—The reason for this state of affairs is readily discovered. I observe that I possess a certain bodily form and behave in certain ways. When I see like forms and activities in other beings I naturally, and perhaps uncritically, infer that like experiences are present. It is precisely this process of inference which leads me to say, under certain circumstances, that my friend is in agony, in sorrow, in amazement, or in ecstasy. I see simply that he behaves as I should were I experiencing the emotions. Common expression has it that a person acts or behaves as though he were in pain, or in sorrow; as though he saw a strange sight, or heard an unexpected sound; as though he were puzzled, annoyed, or uncertain. Almost every statement which we make about one another involves the use of inference of facts of consciousness from facts of behavior. The matter is summed up in the statement that behavior has come to mean for us certain experiences.

The great gulf between ant and man.—When in an organism which is as different from us in form as the ant,

we observe behavior which we should in a fellow man interpret as indicative of rage, fear, delight, we are puzzled, for although the behavior itself tempts us to say that the animal is having these experiences, its marked difference from us in form makes us cautious and we are likely either to suspend judgment or to cease to attempt to decide. The fact seems to be that most persons do not try to understand the ant as conscious. They accept its behavior as they would that of an oyster—which they eat alive without a thrill or shudder. The ant is living, but for them it is not sentient, not conscious. On the other hand, those who have studied ants carefully think of the creatures as conscious.

Thus even so critically conservative a scientist as Professor Wheeler, as previously quoted, writes, "after a patient, and, I believe, unprejudiced study of ants, I have reached the same conclusions as Forel, Wasmann, and others, namely, that these insects show unequivocal signs of possessing both feelings and impulses. In my opinion they experience both anger and fear, both affections and aversions, elation and depression in a simple "blind" form, that is, without anything like the complex psychic accompaniment which these emotions arouse in us." (Wheeler, W. M.: Ants, p. 529.)

It is illuminating to note that the more familiar we become with any sort of living thing—man, ant, or jellyfish—the more strongly are we inclined to think of it as possessing awareness. An animal tends to become increasing psychological for us as we become intimately acquainted with its life. This is one of the most powerful arguments in favor of the study of Animal Psychology in educational institutions. We live in a world of living things and it is only reasonable that we should seek to understand and sympathize with them. Sympathy of the morbid, sentimental sort is baneful: it should be replaced by enlightened

rational sympathy, for this alone can make for genuine kindness to man and beast, and for rational living.

Signs of consciousness are constantly used even by those persons who have never thought of consciousness. Is it not reasonable, then, that we should seek to learn something about the basis upon which we attribute consciousness to other beings? Is it not obvious, in fact, that we should systematically study the grounds upon which we attribute consciousness to objects?

Behavior a variety of bodily process.—Facts of bodily form and function, of whatever kind, may be correlated with mental processes. In the previous chapters we have considered especially those bodily processes which, like the physiological changes wrought in the body by external or internal stimuli, are not readily observed. In the present chapter we shall consider, instead, bodily changes which are obvious. These are the facts of behavior. When an organism moves the whole or a part of its body it exhibits activity. This may be of many kinds, as well as of varying amounts. After briefly surveying the chief varieties, we may seek the facts of correlation of behavior with mental phenomena.

Varieties of behavior.—It will best serve our purpose to separate acts into three categories: those of automatism, instinct, and will. This is intended as a psychological classification of the facts of behavior.

Automatic acts include bodily reflexes of which familiar examples are the heart-beat, respiration, swallowing, winking, and acts which have become utterly habitual, so that we no longer think about their performance or even are aware of doing them. Thus, I quite automatically put on my collar and arrange my tie while thinking intently about some problem.

Instinctive forms of behavior are hereditary adaptations to situations, as are the instances of automatism just cited,

but they differ therefrom, it being more plastic or modifiable, more complex and variable, and most important of all, in being accompanied by a peculiar form of affective consciousness, the instinct consciousness. I act and feel instinctively, when unexpectedly my hand touches a mouse as I am searching for something in the dark. Instinctively the infant imitates the sounds which are produced about it.

Will acts are those forms of behavior which we find it almost impossible to predict. They are relatively slow in execution, and they serve to meet the demands of new situations for which neither automatic nor instinctive provisions are at hand.

Automatism.—Automatic acts are interesting because of the lack of conscious accompaniment. They frequently lie wholly without our awareness. When we attempt to correlate them with consciousness we discover, much to our surprise, that we know little about them and that it is only when some hitch occurs that we become aware of them at all. This correlation is negative. Automatic acts are relatively unconscious. Perhaps it would be safer to say, instead, that they are not ordinarily accompanied by introspective consciousness or awareness. Many of the lower organisms appear to be highly automatic, for the objective indications of this sort of activity are regularity and constancy. When consciousness is present, we expect acts to vary; when it is not, we expect them to be stereotyped.

Two forms of automatic action.—Certain acts are inherited in definite and relatively stable form; they are the primary automatic actions. Examples of this type of activity are knee-jerk, winking, heart-beat, and respiration. Certain other acts are acquired during the life of the individual and by repetition become automatic; they are secondary automatic actions. As examples of individually acquired automatisms may be mentioned the habit of hold-

ing one's pen, of making the letter a, of pronouncing one's name, of buttoning one's coat.

There are acts which are uniform, predictable, almost invariably automatic from the very first appearance in the individual, and there are others which, although lacking these characteristics at first, tend to acquire them with repetition. Automatic acts may be inherited, they may be acquired, they may be partly inherited and partly acquired. In any event, it is certain that the formation of habits means the automatizing of acts by practice.

Instinctive behavior.—Instinct is one of those historical concepts which has been overgrown by meaning. It is so encrusted with traditional significance that it is almost impossible to use it for the exact descriptive purposes of science. In general, it has come to mean acts which are not mere automatisms, but which are guided by what the psychologist calls instinct consciousness. The acts are said to be due to inheritance more largely than to individual experience. An instinct, we are told, is something inborn; a habit is something learned by the individual. I inherited my ability to express certain emotions, but I learned for myself to use the typewriter.

Instinctive acts differ from automatic acts in that they are not quite so stereotyped; they appear to have more leeway. They vary more. They differ from will acts in being hereditary in their essential features instead of individually acquired. The social insects are marked by the possession of a vast number of instinctive acts, whereas we are notable for our will acts. Instinct and intelligence are often said to be opposed, and it is frequently claimed that intelligence grows out of instinct. From the point of view of the writer, it would be as sensible to claim that our ability to swim grows out of our ability to walk. Instinct and intelligence are two quite different organic qualities. In some organisms the one, in some the other pre-

dominates, but every being possesses both. They are fundamental tendencies in living things. Organisms differ in degree with respect to both; they never wholly lack either. Neither has sprung from the other.

The relation of instinctive behavior to consciousness.—It is to be noted that the presence of instinct has come to mean that the creature is not intelligently aware of what it is doing or of why it behaves as it does. When the chick, or the baby, instinctively seeks food, in its characteristic way, we simply say that it is guided properly by its instinct. The man may intelligently, reflectively, rationally, meet, with suitable behavior, the same situation to which the chick responds instinctively and without consciousness of either the how or the why of its behavior. Instinct, indeed, is said to be God's substitute in the brutes for intelligence or reason. Omitting in them the insight which he gave to man, he endowed them with something which is thought to take the place of reason. This conception of instinct in its relation to intelligence and reason is, in many respects, misleading. In the first place, instinct does not replace reason or intelligence. Rather, it exists side by side with them and only in part does it, or can it, take their place. What instinct does in animals, it does also in man, but man possesses the power of insight or rationality as it exists in no other creature.

Instinctive behavior is not unconscious behavior.—There is an instinct consciousness. It is clearly present in each of us when we act instinctively. Why should we not suppose it to be present likewise in other beings.

"But instincts are more than innate tendencies or dispositions to certain kinds of movement. There is every reason to believe that even the most purely instinctive action is the outcome of a distinctly mental process, one which is incapable of being described in purely mechanical

terms, because it is a psycho-physical process, involving psychical as well as physical changes, and one which, like every other mental process, has, and can only be fully described in terms of, the three aspects of all mental process —the cognitive, the affective, and the conative aspects; that is to say, every instance of instinctive behavior involves a knowing of some thing or object, a feeling in regard to it, and a striving towards or away from that object. . . .

" In the animals most nearly allied to ourselves we can, in many instances of instinctive behavior, clearly recognize the symptoms of some particular kind of emotion such as fear, anger, or tender feeling; and the same symptoms always accompany any one kind of instinctive behavior, as when the cat assumes the defensive attitude, the dog resents the intrusion of a strange dog, or the hen tenderly gathers her brood beneath her wings. We seem justified in believing that each kind of instinctive behavior is always attended by some such emotional excitement, however faint, which in each case is specific or peculiar to that kind of behavior. Analogy with our own experience justifies us, also, in assuming that the persistent striving towards its end, which characterizes mental process and distinguishes instinctive behavior most clearly from mere reflex action, implies some such mode of experience as we call conative, the kind of experience which in its more developed forms is properly called desire or aversion, but which, in the blind form in which we sometimes have it and which is its usual form among the animals, is a mere impulse, or craving, or uneasy sense of want. Further, we seem justified in believing that the continued obstruction of instinctive striving is always accompanied by painful feeling, its successful progress towards its end by pleasurable feeling, and the achievement of its end by a pleasurable sense of satisfaction.

"An instinctive action, then, must not be regarded as simple or compound reflex action if by reflex action we mean, as is usually meant, a movement caused by a sense-stimulus and resulting from a sequence of merely physical processes in some nervous arc. Nevertheless, just as a reflex action implies the presence in the nervous system of the reflex nervous arc, so the instinctive action also implies some enduring nervous basis whose organization is inherited, an innate or inherited psycho-physical disposition, which, anatomically regarded, probably has the form of a compound system of sensori-motor arcs.

"We may, then, define an instinct as an inherited or innate psycho-physical disposition which determines its possessor to perceive, and to pay attention to, objects of a certain class, to experience an emotional excitement of a particular quality upon perceiving such an object, and to act in regard to it in a particular manner, or, at least, to experience an impulse to such action." (McDougall, Wm.: An Introduction to Social Psychology, pp. 26-29.)

Double meaning of the word instinct.—Instinct should stand for a certain variety of behavior and for a certain kind of consciousness. At present it is used for both, but vaguely and not with agreement among authorities. Certain psychologists, for example, claim that the term is purely biological in its meaning and that there is no consciousness corresponding thereto. We might of course speak of instinctive action and instinct consciousness, but that would be awkward. However, the fact remains, as Professor McDougall has made clear, that in introspection we discover a consciousness which accompanies instinctive acts. The instinct consciousness is especially interesting because a study of it should give us insight into the mental lives of those creatures in which intelligence and rationality are overshadowed by instinct.

It is one of the chief purposes of this discussion to help

to eradicate the prevalent false notion that instinct is the exclusive possession of brutes and rationality that of man. Each possesses both; and both are important to each. Such general statements as are common in popular books on animal behavior and intelligence contain, as a rule, just enough truth to be misleading. The dog is not merely a creature of instinct; man is not merely a creature of reason. The systematic critical investigation of animal behavior and consciousness is tending to convince those whose preconceptions and prejudices are not impassable barriers, that many animals possess more of rationality than has ordinarily been supposed, and that man is often merely instinctive where we are wont to consider him rational. Professor McDougall, whose book on "Social Psychology" deserves to be read, instead of quoted, even goes so far as to write: "But mankind is only a little bit reasonable and to a great extent very unintelligently moved in quite unreasonable ways" (p. 11). Two of these ways in which man is moved are the automatic and the instinctive.

Volitional behavior.—Voluntary acts, so-called, or will acts are supposed to spring from one's mental life. Man is said to possess a will and certain of his acts are supposed to be an expression thereof. Thus it comes about that in addition to his instincts, certain acts are described as signs of volition. But what, we may inquire, are the marks of an act of will? First one notes hesitation, delay, variability. The will act is noteworthy in that it fairly well suits the situation, even though the latter be new in the experience of the person. It is unpredictable, unique, not stereotyped or uniform in occurrence. It can be understood only in connection with the particular situation in which it appears, for to that especially it belongs. It may never again occur. In this it differs radically from the automatic and instinctive acts, for they lack distinctive individuality and are in no sense unique. They may be

called into being repeatedly by the presentation of the situations to which they are suitable.

When we observe in an animal uniquely individual acts, we infer that it possesses volitional consciousness. The correlation is ready-made, we do not have to think it out. When I observe a man standing on the street corner looking now this way, now that, I do not long hesitate in attributing to him uncertainty. I take it that he lacks certain information, certain conscious processes, which would enable him to decide which road to take. I infer that he is thinking, reflecting, deliberating, preparing to will. And, upon the basis of this inference, I approach him in order to offer assistance. I act simply and solely upon the basis of what I see him doing. I interpret his behavior in terms of consciousness, and my own behavior is determined by this interpretation.

The characteristics of habit.—Given a will act, it may with frequent repetitions change in character so that it is no longer recognized as voluntary, but, instead, as habitual. Last month I had to learn to work the combination of a new locker. I have performed the necessary movements of opening the door scores of times since then and with this result. What at first was vividly conscious and fully occupied me so that I could neither think nor talk while I was trying to open the door, has become almost unconscious. For I now do the act automatically or nearly so. All that I need to do is start the process and while I am talking to a friend or planning the day's work the series of acts gets itself performed and lo! the door is open before me.

The supreme value of habit.—Were we unable to acquire habits or to relegate acts to lower levels of consciousness than the volitional, we should not be able to do more than a small fraction of what we now accomplish. Our attention would not suffice. As it is, this or that act

is gradually relegated to the realm of secondary automatism and we are enabled constantly to learn new acts.

A habit is a will act which has lost its characteristic conscious accompaniment, and at the same time become more or less stereotyped. A reflex is an act which, so far as the knowledge of the individual goes, never has been accompanied regularly by volitional consciousness.

An observer of my behavior with reference to the locker would have noticed the hesitation, deliberation, uncertainty with which I acted at first and he would almost certainly have interpreted my behavior as indicative of thought and of volitional consciousness. Indeed, my acts must have indicated, must have meant, volition to him. Watching me to-day he exclaims, " How machine-like the process of opening that door has become since I first saw you operate the combination last month! You appear not to have to think about what you are doing; you don't even count the number of turns! " This is habit-formation. The above process is typical of what is happening in each of us daily. Activities, modes of behavior, which at first are accompanied by varied and clear consciousness of the volitional sort, with repetition gradually lose this accompaniment and stand forth as habitual acts—acquired automatisms—instead of as will acts.

Two directions of development of activity.—The first is toward increasing degree and complexity of conscious accompaniment, as indicated by introspection, and the second is toward diminishing degree and complexity of conscious accompaniment. In the voluntary acquirement of a new act and in the acquisition of control over instinctive acts we discover the first process. In the perfecting of a voluntary act beyond the point of accurate adjustment to the demands of the situation we discover the second. From instinct to intelligence and rationality marks the progress from the less complex to the more complex consciousness.

From volition to habit marks the progress from the more complex to the less complex consciousness.

The task of correlating behavior and consciousness.— It is one which has gone on largely without reflective and critically intelligent guidance. We simply have grown into certain ways of thinking about the relation of behavior to consciousness. They now seem to us necessarily correct. We are so accustomed to eating live oysters that we are first amused, then surprised, when a scientific friend urges that it is a case of cruelty to animals. And similarly, we are so in the way of thinking of our pet dog as next in intelligence to ourselves that it seriously offends us to be told that he no more understands what is said to him than does the weather vane.

But obviously this correlation of behavior with consciousness should be made with scientific care and circumspectness. It determines our conduct toward one another, and it is therefore desirable that we should not have false standards of judgment. The only way to render our correlations scientific is to study the so-called signs of consciousness thoroughly in order to make as sure as we can what their psychic accompaniments really are. It is clearly our duty to study with extreme care all of the facts of structure and behavior which are in any measure indicative of consciousness. This students of Animal Psychology are to-day doing.

CLASS EXERCISE

Observation. Study of the behavior of a person, with the intention of interpreting it psychologically.

After a preliminary explanation of the exercise, the instructor should act out before the class some simple thought process. By facial expression, gestures, and other motor processes, he should attempt to exhibit what is going on in his mind.

Immediately after completing the "behavior" process, he should write an accurate account of his consciousness. At the

same time each member of the class should describe the "behavior" and therefrom infer the consciousness which accompanied it.

The results of this exercise will be most satisfactory if the instructor limits his expressive "behavior" to a few seconds.

SUPPLEMENTARY READING

McDougall, Wm.: An introduction to social psychology, chapters 2 and 3.

James, Wm.: Principles of psychology, vol. 1, chapter 4; vol. 2, chapter 24.

Morgan, C. Lloyd: Introduction to comparative psychology, chapters 11 and 12.

Titchener, E. B.: Text-book of psychology, §§ 121-127.

PART SIX

PSYCHOLOGY AND THE CONTROL OF MENTAL LIFE

CHAPTER XXX

THE PREDICTION AND CONTROL OF EVENTS

"Modern science, as training the mind to an exact and impartial analysis of facts, is an education specifically fitted to promote sound citizenship.

"Our first conclusion, then, as to the value of science for practical life turns upon the efficient training it provides in method. The man who has accustomed himself to marshal facts, to examine their complex mutual relations, and predict upon the result of this examination their inevitable sequences—sequences which we term natural laws and which are as valid for every normal mind as for that of the individual investigator—such a man, we may hope, will carry his scientific method into the field of social problems. He will scarcely be content with merely superficial statement, with vague appeal to the imagination, to the emotions, to individual prejudices. He will demand a high standard of reasoning, a clear insight into facts and their results, and his demand can not fail to be beneficial to the community at large."—PEARSON, KARL: The grammar of science, p. 9.

Knowledge does not imply foresight.—We may know a great deal about an event without being able to predict its occurrence, or to foresee it. Thus, the sum of our knowledge of earthquakes, tornadoes, droughts does not enable us to foretell and prepare for them. In such cases we are wont to say either that we are unable to explain the events or that the facts are so difficult to observe that we usually lack the information needful for prediction. We are aware of many things which we can not at present understand, explain, predict.

Awareness versus foresight in animals.—Man seems to be preëminently the explaining creature. He is not satisfied with the knowledge which suffices for the simple description of objects or happenings; instead, he constantly seeks explanations which shall enable him to describe the conditions of his observations. Most animals appear to be content with awareness; man demands the power to foresee events. In this respect we are in infancy animal-like, but as we develop we acquire interest in the conditions or causes of things and we pester our parents, teachers, fellow-students with questions. Here is excellent reason for the fact that science is explanatory and not merely descriptive.

What enables us to predict events.—Whether or not we admit that the goal of science is the control of phenomena, we must grant the desirability of foresight and preparedness. It is therefore worth while to inquire, What sort of knowledge gives us control of physical and psychical phenomena? The question is not difficult. Knowledge of the conditions of an event enables us to predict it. But the power correctly to predict or foresee events is not necessarily accompanied by the ability so to alter the conditions of the event as satisfactorily to control it. There are indeed many things which we can, all too certainly for our peace of mind, predict, but over whose occurrence we have no control. The dread disease whose symptoms are unmistakable and whose invariable termination is death may be beyond our control. Helplessly we foresee the ending of the life of the individual. If we know the causes of the disease we may predict it, but that knowledge does not necessarily enable us also to control it.

Professor Stout's opinion concerning explanation and the prediction of events.—"The power of explanation should involve some power of prediction more or less precise. This power is restricted in psychology because of the extreme complexity of the conditions of the mental life.

But it is not absent. We can, for instance, prove that the exclusive use of certain kindergarten methods in the education of young children will arrest the development of imagination and lower the general level of intelligence. We can predict that close contact of savages with a civilization which they can not assimilate will demoralize them in some respects, if not on the whole. We can predict that a body seen with one eye at a certain distance from the observer will alter its apparent configuration if the distribution of light and shade on its surface is altered in certain ways. Such examples might be indefinitely multiplied. But it is to be remembered that such prediction is nearly always conditional and liable to exceptions, owing to the presence of factors which counteract those on which the prediction is founded. For instance, we can not by altering the distribution of light and shade cause a human face to appear concave instead of convex. The ordinary appearance is too familiar and habitual for this to be possible." (Stout, G. F.: The Groundwork of Psychology, p. 12.)

Foresight forces the search for control.—The ability to anticipate events is naturally accompanied by the desire to avoid undesirable and to bring about desirable happenings. Foresight inspires the striving for control of phenomena. The misery of helplessness exists only by reason of foresight. Animals with keen awareness of what is happening about them, but lacking glimpses into the future, are not concerned with the control of phenomena, nor can they suffer expected misfortune. It is man's ability to anticipate events in imagination that renders him both supremely miserable and supremely happy. If "foresight" did not lead us to "control," we should indeed be less fortunate in our mental lives than are the creatures of mere awareness.

The prediction and control of physical events.—With the causal relations of events in the world of physics, our

physical, as contrasted with our psychical, environment, we have familiarity which renders more than passing notice of the facts unnecessary. So accustomed are we to anticipate the snap and flash when a match is quickly drawn over sandpaper that we seldom think of our foresight in the matter. Nevertheless, we are quite capable of controlling these same events when we so desire. We may so construct the match that the snap shall not occur, or we may, by modifying certain conditions of the events, prevent the occurrence of both snap and flash. Indeed, day by day we exercise control over a multitude of events before which other animals are helpless. Prediction and control are commonplaces of our lives and therefore difficult to appreciate.

When the physical cause is immediately followed by its effect or effects, prediction seems fairly easy. We observe the breaking of a bottle when it is placed in hot water and we causally link the events. But we are less likely to predict and successfully to control those effects which follow their causes only after an interval of days, weeks, or months. It is the separation of causally related events which renders the tasks of prediction and control difficult.

Can mental phenomena be predicted?—No one questions our ability to foresee innumerable physical events which are of importance in our lives, and to control many of them, but many persons seriously doubt whether mental happenings can similarly be predicted. What is the truth, as indicated by observation?

Self-observation reveals sequences in mental life. The thought which I am now experiencing followed the appearance in consciousness of certain ideas. The ideas became related and I became aware of a thought process. Or, suddenly, as I am writing, the sensation of the sound of a bell, which I recognize as the fire signal, comes clearly

to consciousness. An instant later I experience an image of another auditory sensation, that of a shrill whistle, which has frequently in my past experience accompanied the former sensation. Yet another example may be given of psychic sequences. As I was finishing the writing of the foregoing sentence the name Francis Galton came to consciousness auditorily and verbally, and immediately there passed before my mind's eye visual pictures of his career. Each picture seemed naturally and inevitably to lead to the next. I can imagine the order changed, but in order to do so I have to imagine also certain changes in the nature of the pictures.

These are examples of mental sequences, which, if intimately known, should justify us in maintaining the predictability of psychic events. There are a few mental events which, in the introspection of each of us, may be predicted confidently. There is a multitude of others which we are wholly unable to predict. The latter events, as truly as the former, are caused or conditioned by certain other events, but whereas our scanty knowledge permits us to observe the relation of dependence in the one set of cases it does not in the other.

Some events are easy, others difficult, to predict.— As in the world of physics there are events whose causes are extremely difficult to discover, whereas the conditions of others are forced upon the observer, so in mental life the obviousness of the causal relation of events varies. There is nothing surprising in this, yet many psychologists contend that our inability to predict any considerable proportion of mental events proves conclusively that they are not caused by other mental events. The simple fact that the stimulus word " writer " yesterday aroused the psychic sequence—consciousness of sound and sight of word " writer," visual image of Francis Galton, idea of eugenics, image of book on my desk, etc., and to-day the utterly dif-

ferent series of events—kinæsthetic experience of the word "writer," visual-verbal image of a student, idea of thesis on kinæsthetic sensations, auditory memory of name, etc., by no means proves that the events are not conditions of one another in both instances.

If we knew the psychic facts intimately and thoroughly it would be reasonable to conclude that since "writer" is followed now by one idea, now by another it bears no causal relation to either. What we too readily overlook is the fact that the conditions or causes of events are complex. The simple stimulus-word "writer" is only one of many important conditions of the associated ideas.

The wonder is that we observe as much regularity in the sequence of mental events as we actually do!

Every event may be assumed to have a cause or causes.—Physical scientists work on the assumption that there are no uncaused or unconditioned events. The assumption would seem to be a serviceable one, as judged by the progress which we have made in the prediction and control of events through physical research.

Why may we not make the same assumption in psychology? We may. Indeed, it is the conviction of the writer that we should. Further, the assumption may profitably take the form that every mental event is caused or conditioned by some other mental event or events.

Physics makes allowance for the apparent variations in the effects of a given set of conditions. It does not, as psychology has done, abandon the idea of a causal relation between events because there appear to be exceptions to the rule. Instead, confident of the correctness of its fundamental assumption concerning causation, physics proceeds to seek for variations in the conditions to account for the observed variations in the effects.

The lesson for the psychologist is obvious.—Instead of abandoning the notion of psychical causation because the

same mental event *seems* to condition now one and now another idea, he should look for differences in the conditions which will adequately account for the different effects.

We can predict mental events.—This book has been written from beginning to end, on the assumption that adequate knowledge of the facts of mental life would enable us to predict mental phenomena in precisely the way in which we predict physical events. The foregoing paragraphs, in defense of this assumption, have prepared the reader for the author's answer to the question, Can we control mental life?

The control of mental phenomena.—If mental events cause or condition one another, if we can predict them, and if we have the power to modify the course of these events by changing the psychic environment, then the control of mental phenomena is possible.

We must first demolish the ifs. Mental events do cause or condition one another. There is psychical causation. This matter has been discussed in the light of facts, up to the limits of our space. It is necessary now to make statements dogmatically. But one more word may be said in defense and justification of the position which the writer, in opposition to most psychologists, assumes. He believes that observation indicates psychic causation; he believes that the assumption of the existence of this relation between mental phenomena will conduce to important developments in the science of psychology, and finally, he feels sure that the task of controlling mental phenomena demands precisely the knowledge which research on the basis of this assumption will yield.

If mental phenomena can be predicted, we may hope to gain control over them. Certainly they may be predicted if we are capable of discovering their conditions and if these same conditions are observable prior to the event or events which they condition. Again the ifs disappear

before a dogmatic statement. We can predict mental events. Our success is meager as yet, but that fact is readily explained. The power of prediction depends wholly upon the scope of our knowledge. As we learn more about mental phenomena our ability to predict events of mind correspondingly increases.

The most serious of all the ifs remains. If we have the power to modify the course of mental events we can control them. Have we this power?

Can mind be controlled? How?—We have the power to control mental life, within certain limits, just as we have also the ability to control bodily life. It has been said by the physiologist Professor Jacques Loeb that the goal of the biological sciences is the control of the phenomena of life. Following his line of thought, we may say that the goal of psychology is the control of mental phenomena.

Always in attempting to control consciousness we modify the environmental influences which are acting upon the organism. This is done systematically in education and in eugenics.

The remaining chapters of the book suggest ways in which mind may be modified and controlled. The discussion is necessarily brief and incomplete. Its purpose is to make clear the possibility and desirability of control in the individual and in the race, not to enumerate all the possible modes of control

CLASS EXERCISE

Self-observation. Introspection of thought processes. Material: a set of five questions, prepared in advance by the instructor, to be read to the class. After each question, sufficient time should be allowed for the writing of a full report of introspection.

Suggested questions.

Who is Jumbo?

How long is the Panama Canal?
Can you speak French?
What is the date of to-day?
A boy is to a man as a book is to ——?

SUPPLEMENTARY READING

JUDD, C. H.: Psychology, chapter 15.
PEARSON, K.: Grammar of science, chapter 1.
THORNDIKE, E. L.: Elements of psychology, chapter 21.

CHAPTER XXXI

EDUCATION AND MENTAL LIFE

"What we think and what we do about education is certainly influenced by our opinions about such matters as individual differences in children, inborn traits, heredity, sex differences, the specialization of mental abilities, their interrelations, the relation between them and physical endowments, normal mental growth, its periodicities, and the method of action and relative importance of various environmental influences. For instance, schemes for individual instruction and for different rates of promotion are undertaken largely because of certain beliefs concerning the prevalence and amount of differences in mental capacity; the conduct of at least two classes out of every three is determined in great measure by the teacher's faith that mental abilities are so little specialized that improvement in any one of them will help all the rest; manual training is often introduced into schools on the strength of somebody's confidence that skill in movement is intimately connected with efficiency in thinking; the practical action with regard to co-education has been accompanied, and doubtless influenced, by arguments about the identity or the equality of the minds of men and women; the American public school system rests on a total disregard of hereditary mental differences between the classes and the masses; curricula are planned with some speculation concerning mental development as a guide. It is thus easy to find cases where educational practice depends upon opinions about our group of topics. It is still easier to note a similar dependence in the case of educational theory."—Thorndike, E. L.: Educational psychology, pp. 1-2.

Education is two-fold: physical and psychical.—The practice of speaking of the education of the body and the education of the mind as though they are distinct is justified by the methods and results of educational practice. Physical education, it is true, always influences the mind; and, conversely, psychical education modifies the body. There is much truth in the statement that a sound body and a sound mind belong together.

In this chapter we shall discuss only psychical educa-

tion, and that merely in certain of its important relations to the science of psychology.

Education, an art.—Briefly and inadequately, but sufficiently for our immediate purposes, education may be defined as systematic endeavor to promote, direct, and control the development of mind in the individual. The body of educational practice, the educational system, constitutes an art because it is used to bring about certain psychological developments which are deemed desirable. Education is intensely practical, not æsthetic. There is a popular notion to the effect that education is synonymous with knowledge or learning. The notion is incorrect. Education aims rather at mental efficiency than at knowledge. It is truer to say efficiency is power than to say "knowledge is power." The art of education should, and does, bring knowledge to the individual, but far more it should draw out, foster, and strengthen his mental capacities.

The scientific basis of the art of education.—Every well developed art has a scientific basis. It is in the light of this basis that its products may be predicted. For, in its most highly developed form, an art is the skillful application of scientific knowledge. Now the scientific basis of the art of psychical education is psychological. Mental phenomena can be effectively controlled only in the light of accurate knowledge of the facts and laws of consciousness.

Educational systems are traditional.—At present our systems of education are largely the products of social tradition and of more or less happy guesses concerning events. They are reasoned, but not rational, for the majority of their practices are not based upon definite knowledge of the laws of mind. The teacher, not less than the engineer, should be able to predict with a fair degree of accuracy and certainty, the probable effects of his methods.

Efficiency.—Efficiency depends upon the rationalizing of methods. The efficient workman is the one who has thought out his ways of doing things; compared way with way, eliminated the worse, perfected his skill in the employment of the better. In a word, he is the man who works in the light of a relatively adequate knowledge of facts. "Scientific management" in industry means simply the selection of the fit, suitable, efficient, economical way of working and the abandoning of all less efficient ways.

Everywhere thought makes for efficiency. The person who thinks out his methods of work and acquires habits of basing even the simplest acts upon systematic knowledge of the possible ways of acting leads in the struggle for accomplishment. It is indeed the glory of man that he is capable of substituting thoughtful for blind hit or miss reactions; brain for brawn; insight for learning by trial and error.

Psychology and education.—It is perfectly obvious that psychology should furnish the scientific basis for the education of mind, and it is equally obvious to all who are concerned with educational practice, that it has as yet done so only very incompletely and unsatisfactorily. There is no reason to condemn or criticize educators, for they are eagerly seeking and intelligently using whatever facts and laws of consciousness are made available.

The whole of the science of psychology should be brought to bear upon the problem of educational efficiency. But it must suffice now to call attention, by way of illustration, to a few aspects of the control of consciousness which are receiving the attention alike of educators and psychologists.

Education and the senses.—From birth till death our senses demand intelligent care. They may be so developed as to be efficient contributors to the stream of consciousness, or they may be dwarfed, impaired, distorted so that

their contributions to consciousness are either of slight value or positively baneful.

One of the tasks of education is to control the development of the senses. This control must begin in the home; it must be continued and extended in the schools; it must be maintained by the intelligent individual throughout life.

Physical defects of the sense organs require attention, for normal sensitiveness resides only in the normal healthful body. To attempt to train the vision or touch or hearing of a child without first making sure that the sense organs are normal and in good condition is a waste of time.

The apparently stupid child is not seldom found to lack normal sensations of sight or hearing. With the removal of the cause of the sensory defect there occurs rapid development of mind. Scores of instances of the importance of normal sensitiveness for mental development might be cited. We shall content ourselves with a single case.

At the age of fourteen a boy was brought to Professor Witmer for examination. He was a chronic bad speller and read very poorly. A careful study of his physical and mental characteristics revealed the following sense peculiarity as the chief cause for his mental backwardness. He suffered from a peculiar visual defect which caused objects to appear double. It was only at the cost of strenuous and fatiguing effort that this boy could see clearly the letters of a word. Neither parents nor teachers had discovered this sense defect during the early discouraging years of the boy's school life. He had not spoken of it because he had no ground for supposing that any one else saw differently, and as a consequence his mental development was hopelessly dwarfed.

Of this sad case—and there are many like it in our

schools—Professor Witmer writes: "If the mother or teacher had possessed the knowledge and experience that the study of cases like his will give, he would have been sent early in life to the oculist, his defect of vision could have been entirely corrected, and he would have made normal progress through the grades. His history shows the presence of ocular deficiency from the first school year. Not having been then removed, by the time he had reached fourteen years of age it was too late for him to make up all he had lost. He never acquired normal facility in reading and spelling." (Witmer, L.: The Psychological Clinic, vol. 1, p. 62. 1907.)

That the senses are educable has been amply demonstrated, but we seldom can select with certainty the most efficient method of improving them. It is one of the important tasks of psychology to discover at what periods, under what conditions of life, and by what means our senses should be trained.

Education and perception.—Nature endows us with the tendency to perceive. Education supervises the manifestation of this tendency and determines whether we become able, mediocre, or poor perceptually.

The isolated human being would experience percepts. The uneducated person seems to get along fairly well with his untrained experiences. But these observations do not convince us that perceptual education is valueless. Under the tuition of practiced, skilled, and sensible teachers we acquire perceptual habits which are of incalculable importance for our mental development. In a very true sense of the expressions, we learn to see, to hear, to touch, to taste. The educational influences under which our "learning process" occurs make of us either keen or dull, reliable or unreliable, penetrating or superficial, thorough or careless, honest or dishonest observers. It is the duty of the psychologist so to formulate the facts and laws of our

perceptual processes that the possibilities of controlling them may be studied to advantage.

Education and the will.—Each of us comes into the world provided with a fund of adjustments to environment and capable of receiving certain experiences in connection with the development of these adjustments. We call these provisions of Nature instincts. Instinct may not inappropriately be defined as the Will of Nature expressing itself through us.

It is the function of environment—the whole of which is education—so to develop each of us that the human type of will comes into existence beside instinct. Life is for every human being, first and foremost, a process of acquiring self-control. If the practices of education do not further this process with maximum efficiency, they are unsatisfactory. It is perfectly obvious that we know too little about mind and its growth to be able to estimate the value of most of the educational methods which are in common use.

Education and habit-formation.—In advance of adequate knowledge of ways of controlling the process, we have recognized the importance of the principle of habit. Something like one-third of our lives is "instinct," as much is "habit," and the remainder is in process of becoming the one or the other! No wonder then that education demands a scientific basis for the direction of habit-formation.

It is encouraging to note that recently the phenomena of habit have been so investigated that we have much information about the nature of the process; and it is not less interesting to note that attempts are being made to measure the value of methods of influencing habit-formation. We know, for example, that a few repetitions of a sentence at intervals of a few hours more satisfactorily establishes the process of recall than does an equal number of repeti-

tions at one time. For the acquisition of any habit, we know that there are conditions which are favorable, others which are unfavorable, and we know that the same is true of the retention of habits. The question which is being attacked experimentally is "What is the most efficient method for establishing a certain habit?"

Instead of setting out blindly by a hit or miss method, or even by means of a method which has been in use for centuries but whose efficiency has never been compared with that of other possible methods, to establish a certain habit of mind in ourselves or in others, we should seek first definite knowledge of the values of all the methods which are available.

From an admirable experimental study by Professor Book of the process of learning to use the typewriter the following analysis of the habit complex involved, and of certain results of the investigation are quoted.

"In learning typewriting two groups of special habits are formed: (1) Habits of manipulation, or the specific psycho-physical associations involved in the mastery of the writing itself. (2) Habits of control, certain more general or more purely mental habits formed in conjunction with the habits of manipulation—habits that are not involved in the writing directly, but rather preside over the formation of the special typewriting habits. In other words, in learning to typewrite the learners acquire in addition to the habits of manipulation (the typewriting habits which enable them to deal more and more directly and economically with the particular problems presented by the writing), certain other habits which enable them to deal more and more successfully with the problems involved in the learning itself. Specifically the subjects learn: (a) How to "short circuit," or acquire to advantage the kind of habits which the mastery of the subject requires; (b) How to meet and successfully overcome the many special dif-

ficulties which are characteristic of the learning of typewriting; (c) How to acquire and maintain a helpful attitude of feeling; (d) How to keep attention focused always on the writing; (e) How to use attention more and more effectively when applied to the writing. How better to use and economize voluntary effort, etc.'' (Book, W. F.: The Psychology of Skill, p. 168.)

'' The special typewriting associations or habits of manipulation are all developed and perfected in a definite manner. The earliest associations employed in the writing are formed from the masses of familiar associations and activities which the learner brings with him to the work. In the beginning the learner's attention and effort can not be applied to the writing in a direct and economical way. Under the influence of the strong desire to succeed in the new task there are called up masses of old and easy associations and forms of activity, most of which are not directly serviceable for the writing. From these associations and activities is built up by the double process of elimination and selection the first elementary, step-by-step, blundering associations used. By a further process of elimination and a simultaneous one of recombination, called into action by the extreme exertions of the learners in their eager desire to reach a higher speed and greater facility, their first elaborate and circuitous methods of writing are simplified, refined, changed, until, sheared of some of their accessories, they enter into and form the easiest and most direct method of work yet attained. Throughout the learning there is, if one may so phrase it, a sort of unconscious struggle for existence among many modes of action and methods of work, ending in the survival of the one most direct and economic way of reaching the goal. Some of the early habits called forth by the learning exist but to be eliminated, others enter into and constitute the first simple and direct habits used in the writing. These ele-

mentary habits are in turn modified and reorganized, as practice continues, as parts of higher and more economical groupings, in which their identity is gradually merged, while these higher groupings in turn are worked over into yet higher complexes by essentially similar processes" (p. 170).

"The most important factors influencing the formation of the special habits involved in typewriting are the fluctuations in attention and effort, which occur throughout the course of the learning, and the mistakes fallen into, and changes in feelings and attitude which regularly accompany both of these" (p. 173).

"Besides determining the special habits of every kind and order involved in the mastery of typewriting and showing concretely, by a minute history of the learning process, how these habits were developed and perfected as successively organized and recombined into associations and habits that bring the learner always more directly and economically to his goal, this study has shown the important rôle played in the learning, by effort and hygiene. Two facts stand out above all the rest: (1) All special habits and associations involved in the mastery of typewriting must be carefully perfected. (2) They must then as rapidly as possible be outgrown and give way to higher and more direct habits of writing. Bryan and Harter were right when they said: 'We believe that by no device is it possible to gain freedom in using the higher-order habits until the lower have been so well mastered that attention is not diverted by them.' They suggested a truth of still greater importance when they added: 'It is, nevertheless, wise at all times to practice with the highest units possible, and thus learn all the units in their proper setting.' (*Psy. Rev.*, vol. 6, p. 368, 1899.) The older elementary habits tend naturally and strongly to persist and must be left behind as rapidly as possible to prevent arrest. To

try to crowd ahead before the elementary habits are sufficiently mastered to make safe the taking of a forward step, or to fail to perfect the elemental associations which must be combined to form the higher and more direct methods of writing, is fatal to progress or interest. To be caught by the law of habit and continue to think or work on a low plane when new possibilities of improvement lie ahead is just as fatal. It is, therefore, imperative that the learner should always practice with the highest-order habits he can use. But he must not try to go too fast. Great effort wrongly or carelessly applied is even more detrimental to progress than a simple lapse in attention and effort. Since all the special habits to be formed must be religiously guarded in the last stages of their development to be thoroughly mastered, and since these habits are developed simultaneously and literally perfect each other, and since intense effort is required to make a forward step, the vital problem in learning resolves itself into making the right use of attention and determining how fast to push ahead. The tendency to slight the associations in the last stages of their development and to push ahead too fast, can, of course, best be overcome, in typewriting, by not always practicing at maximum speed, for the effort for speed usually means that attention deserts the details of the work. To perfect carefully the elemental associations it will, therefore, be found better practically, to practice most of the time for accuracy alone and only a small part of the time for speed, a custom generally followed by the best typewriting schools. This would insure the perfection and mastery of the elemental associations and habits. But it is just as essential for progress that the learner should push along as fast as he can and so develop all the habits in their proper setting and avoid falling into a habit of laziness" (pp. 178, 179).

"It is not what the learner would like to do, but what

his mental and physical condition at the time of study or practice will let him do, that is important for determining his progress. The process of learning typewriting is something like mowing a field. The farmer takes out his machine to cut his grass. He can only keep his machine in good condition and vigorously applied to the work; the machine does all the rest. It does its own work in its own way. How well it works depends upon the nature and condition of the machine. So with a learner in typewriting; he begins to learn to use the typewriter. How well he does the work, how rapidly he improves, depends, (1) upon how strenuously he keeps himself applied to the task, (2) upon the learner, the mental and physical condition of his organism. He must keep himself in perfect condition and strenuously applied to the work; the organism does all the rest. He needs but to consciously lay hold of and make proper use of the adaptations that are unconsciously fallen into, the habits and associations formed. All this suggests that if one wants to improve at the most rapid rate, he must work when he can feel good and succeed, then lounge and wait until it is again profitable to work. It is when all the conditions are favorable that the forward steps or new adaptations in learning are made. Whether the older associations are at such a time also more rapidly perfected or whether monotonoús practice will answer as well in stimulating their growth we can not say" (pp. 180, 181).

The significance for education of such studies as Professor Book's.—By the experimental study of the learning process in its various aspects and by careful measurement of the effects of educational conditions upon the process, and thus alone, can the best methods of controlling consciousness and of directing mental development be selected.

Professor Book's work has been quoted at great length because it is a splendid example of the type of research

which the art of education demands in order that it may safely and sanely be based upon scientific knowledge of mental life and of its control.

Education and individual differences.—Alike mentally yet sufficiently different to demand varied modes of educative treatment, we human beings present in equal measure to psychologist and teacher special and individual problems. The psychologist may not safely assume that two individuals are alike in type of reproductive memory; nor may the teacher assume that a training method will affect both alike.

Recently there has come into use the expression "the psychology of individual differences." This is clearly indicative of the degree of importance of the matter and of the attention which is being given it. In education, likewise, effort is now concentrated on the needs of the individual, and especially on the relations of educative methods to the physical and psychical traits of the individual.

Status of the control of mind in the individual.—At present we do not, can not, to any marked degree, control the mental processes in the individual. The status of the matter is encouraging rather because of the widespread realization that control is possible and that it must be attained than because of achievement. Investigation is rife: progress is thereby assured. Psychologists on the one hand are diligently studying consciousness and eagerly seizing upon results which appear to have value for the art of education. Teachers, on the other hand, are striving for efficiency through the testing of methods and the observation of individual differences.

There is a rapidly growing body of knowledge, known as educational psychology, from which much may be expected in the future for the control of mind.

CLASS EXERCISE

Self-observation. Introspection of reasoning process. Materials: some simple object or part of an object, the use of which no member of the class is likely to know with certainty.

Having explained to the class the nature of the introspective task and rendered the explanation concrete by a description of some simple process of reasoning (examples may be found in Dewey's How we think), the instructor should for a few moments present to view the object whose use is to be reasoned out.

Whether or not a self-satisfying conclusion is reached in the reasoning, each member of the class should carefully and fully describe the steps in the reasoning process.

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Whipple, G. M.: Manual of mental and physical tests, chapters 1 and 2. (Bibliography.)
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CHAPTER XXXII

EUGENICS AND MENTAL LIFE

"Eugenics is the study of agencies under social control that may improve or impair the racial qualities of future generations either physically or mentally.

"The fact that the laws of heredity apply to man equally with the lower animals and plants, and that the mental functions are subject to the same laws of heredity as the physical ones, has yet to be taken to heart by the public.

"The salutary effects of natural selection in preventing the degeneracy of a race are so largely interfered with, and sometimes even inverted, by civilization, that another form of prevention is peremptorily demanded.

"If we apply the general word degenerate to the insane, to the imbecile, to the habitual criminal, and to those who are naturally liable to some of the more serious diseases, it is found that a 'degenerate' is no less fertile than a normal person, apparently a little more so, and that such persons frequently marry."—SALEEBY, C. W.: Parenthood and race culture, p. 374. (Quoting Francis Galton.)

A definition of eugenics.—Eugenics has been defined as the science of race improvement. It might more appropriately be termed the art of race improvement. Its task is that of modifying the physical and mental constitution of races by means of the knowledge which the biological sciences, and especially heredity, furnish. We shall limit our present discussion to the bearings of eugenics upon mental life.

Education and eugenics contrasted.—Education deals directly with the mind of the individual. It directs its development, modifies its activities, leads it to efficiency. Eugenics deals instead with mind in the race. It directs the course of phylogenesis by controlling inheritance, and it thus makes for increased efficiency in the individual.

Inheritance: scope and significance.—" Like tends to produce like." This is as true of mind as of body. The mental traits of father and mother, as well as of more remote ancestors, appear more or less clearly in the children. This fact is recognized by education and by eugenics. The former, accepting the hereditary constitution of the individual, strives to make the best of the possibilities of development, strives ultimately to lead the individual to highest mental efficiency. The latter works, through the principles of heredity, toward a more desirable constitution in the individual. Education accepts as its starting point what eugenics seeks to control. It is therefore evident that the achievements of the art of education are conditioned by those of its infantile sister, eugenics.

Examples of psychic inheritance.—The clearest and most convincing cases of the direct inheritance of mental traits are those of mental defects.

From a recent report of studies on " Heredity of Feeble-mindedness " by Doctor Goddard the following cases are selected. They are representative of the family histories of hundreds of individuals whose sad inheritances render them pitiable objects of care in our training schools, hospitals, and reformatories. The facts are horrible to contemplate, but we may not ignore them.

A brother and sister, both feeble-minded, were discovered to have three brothers and one sister, all mentally deficient. The father and mother were feeble-minded. In the mother's family there were two girls and one boy, all defective. In the father's family there were four feeble-minded children. The maternal grandparents of the children in question were feeble-minded, but of the paternal grandparents the grandfather was not mentally defective, although the grandmother was known to be feeble-minded.

Chart B, Fig. 12, briefly tells the story of these children,

for whom birth was a misfortune too distressing to dwell upon.

Another case is thus reported by word and chart (A, Fig. 12).

This history " shows a marked instance of the defect

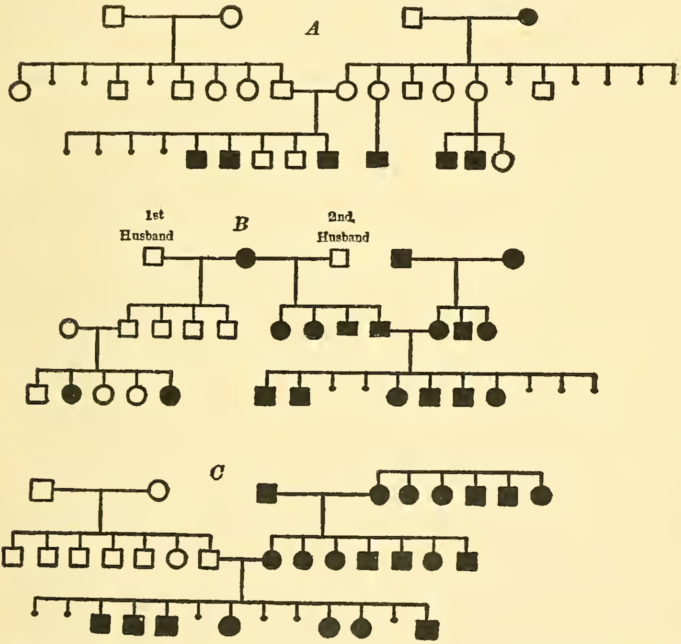

FIG. 12. Charts indicating the inheritance of feeble-mindedness. These charts are somewhat simplified from Doctor Goddard's. (Circles represent females; squares represent males; light circles and squares represent individuals who were not feeble-minded; black circles and squares represent those who were feeble-minded.)

skipping a generation. The maternal grandmother was feeble-minded, her husband was alcoholic, but not one of their children was defective. Indeed, four of them were distinctly normal. However, the mother of our child [in

the Vineland Training School] had had St. Vitus dance, a brother is alcoholic, a sister had had St. Vitus dance, and another hysteria, but mentally they were not defective.'' (Goddard, H. H.: Heredity of Feeble-mindedness, *American Breeders Magazine,* vol. 1, p. 169. 1910.)

Yet a third case is represented in Chart C of Fig. 12. Its meaning, as those of Charts A and B, is explained by the legend below the figure.

These are not exceptional cases.—Daily, social workers in settlements, hospitals, charitable institutions, physicians in their practice, neurologists, and psychologists are brought face to face with precisely such appalling instances as the above of man's inhumanity to man. Human sympathy and justice demand that society take measures to control the conditions which produce mental degeneracy.

Contrasts in psychic inheritance.—A comparison of the history of two well-known families: the one famous, the other infamous, affords, writes Mr. Boies, '' this impressive illustrative contrast between the heritage of good and bad parentage, during substantially the same one hundred seventy-five years of the same American environment.'' (Boies, H. M.: The Science of Penology, p. 326—quoting A. E. Winship.) The families referred to and thus summarily described are those of Jonathan Edwards and the Jukes.

The Edwards family.—''Jonathan Edwards, born East Windsor, Conn., in 1703: 1,394 of his descendants were identified in 1900; of whom 295 were college graduates; 13 presidents of our greatest colleges; 65 professors in colleges, besides many principals of other important educational institutions; 60 physicians, many of whom were eminent; 100 and more clergymen, missionaries, or theological professors; 75 were officers in the army and navy; 60 prominent authors and writers, by whom 135 books of merit were published and 18 important periodicals edited;

33 American States and several foreign countries and 92 American cities and many foreign cities have profited by the beneficent influence of their eminent activity; 100 and more were lawyers, of whom 1 was our most eminent professor of law; 30 were judges; 80 had held public offices, of whom 1 was vice-president of the United States; 3 were United States senators; several were governors, members of Congress, framers of State constitutions, mayors of cities, and ministers to foreign courts; 1 was president of the Pacific Mail Steamship Company; 15 railroads, many banks, insurance companies, and large industrial enterprises have been indebted to their management.

Almost if not every department of social progress and of the public weal has felt the impulse of this healthy and long-lived family. Penology and prison management have occupied their attention and been improved by its members. It is not known that any one of them was ever convicted of crime."

The Jukes family.—" 'Max,' the progenitor of 'the Jukes,' was born in 1720. He was a drunkard who would not work; about whom little else is known.

"Of his descendants 1,200 were identified as having been occupants of penal and charitable institutions, previous to 1874; none of whom were ever elected to office, served in the army or navy, or contributed anything to the public welfare; but on the contrary they cost society over $1,000 each; or a total of $1,250,000; 310 were in poorhouses, 2,300 years in all; 300, or over one in four, died in childhood; 440 were viciously diseased; 400 physically wrecked early by their own wickedness; 50 were notorious prostitutes; 7 were murderers; 60 habitual thieves, who spent an average of 12 years each in prison; 130 were convicted more or less often of crimes.

"The Jukes family never mingled any good blood with its own. The Edwards family has instinctively protected

its blood from degeneration by careful and prudent marriages. The Jukes family is fortunately becoming extinct; although " the mills of the gods grind slow." The Edwards family bless the world with numerous children. If the records of the female side of the house could be collected the contrast would doubtless be doubled. It is impossible to compute, almost so to overestimate, the value of such citizens to the State."

Psychic inheritance in royalty.—As Doctor Frederick A. Woods has convincingly shown, royalty furnishes numerous instances of the transmission of mental peculiarities. Of these instances few are as instructive as the group of which Isabella of Spain, to whom Columbus owed so much, is the center.

Queen Isabella was the daughter of an imbecile father and an insane mother. But, far from being mentally deficient, she was renowned for her intellectual gifts. She married Ferdinand who, although not her equal intellectually, was mentally sound and of fair ability. One of their daughters was Joanna " the mad." In her the defects of the maternal grandparents reappeared. Another daughter, Mary, was not defective. Joanna married Philip, mentally a weakling, and to them was born Charles V, a victim of melancholia, and Catherine, who was mentally sound. Mary married Emanuel, also a weakling, and of their children, a daughter, Isabel, was normal, and a son, John III, was a weak-minded individual. He married his cousin Catherine, and their daughter, Mary, later married Philip II, the morose and cruel son of Charles V and his wife, who was also his cousin, Isabel. To Philip II and Mary was born Don Carlos, one of the most depraved and cruel of men.

This history is but one of many of which civilization has abundant reason to be ashamed.

A fundamental consideration.—Man's success in the struggle for perfection depends upon mind. In the brute,

strength spells success; in man mental initiative and reasoning power are its substitutes. It therefore behooves us to seek that control of mind which shall enable us to improve the race. Not content with Nature's way, for it is often extremely wasteful, indirect, and slow, we should strive, by the scientific study of the facts of inheritance, to learn how to control consciousness.

The goal of eugenics.—In the words of the late Sir Francis Galton, the founder of this immeasurably important social movement, eugenics "is the study of agencies under social control that may improve or impair the racial qualities of future generations either physically or mentally."

Eugenic methods.—For every reader of this book who refuses to grant the desirability of the goal toward which eugenics moves, there will be scores who frankly admit that they can see no way of approach to the goal.

The problem of methods or means for race improvement is difficult. Fortunately we need not attempt to solve it now. It will suffice to indicate certain possible eugenic methods which are at hand and may readily be perfected.

There are in reality two tasks for eugenics. The first is the prevention of race deterioration through inheritance. The second is the improvement of the race. The first is merely negative, but it conditions progress. The second is positive and therefore of infinitely greater importance. Nevertheless, the first task is the one which most urgently demands attention.

Mental degeneracy and its prevention.—Feeble-mindedness and mental defects of many kinds are definitely heritable. In the face of positive knowledge of this fact it is obviously the duty of society to prevent the marriage of individuals who are not mentally sound. Justice to those who support its burdens as taxpayers, philanthropists, social workers, and to children yet unborn whose chances of normality are slight, demands that society prevent the

marriage of imbeciles, of idiots, of simpletons, of slaves to alcohol or any other poisons whose effects upon body or mind are known to be heritable. The cure for race deterioration is the selection of the fit as parents.

Mental evolution and its factors.—It is not so easy to point a practicable way to the production of a higher, more efficient, type of mind than now exists in the human race. Theoretically the problem seems fairly easy of solution; practically it proves to be extremely difficult.

It is said by the theorist, " since mental traits are heritable, all that is needful is to select as parents those individuals in whom the desirable traits appear markedly and in proper relation to other characteristics." There is nothing simpler, it is said, than to breed for intelligence. The difficulty arises from the fact that selection can not be practiced in the case of man, even for good reasons, as it is practiced by breeders of plants and of domestic animals. There is, however, no alternative method to suggest. If mind is to be improved it must be by the selection of the *eminently* fit as parents.

Control the result of science.—Control is the outcome, albeit not the avowed goal, of scientific research. The greatest of physicists, chemists, biologists, sociologists, and psychologists have regarded as belittling the suggestion that they sought knowledge for its usefulness. This attitude is admirable, but it fortunately does not lessen the practical value or usefulness of the discoveries of these disinterested investigators.

Psychology is not the science of mental control. It merely makes possible in increasing measure this control. It is the science upon which both education, the art of the control of mind in the individual, and eugenics, the art of the control of mind in the race, must be founded.

CLASS EXERCISE

Self-observation. Introspection of consciousness of meaning. Materials: A number of words and sentences prepared in advance by the instructor.

In explaining what is expected in this exercise the instructor should give from his own experience, or from the literature on "thought," instances such as the following: (1) Professor Southard states that doubt is symbolized for him by the image of two dog ears pointed forward. (2) Professor Titchener tells us that he sees "meaning" as the blue-gray tip of a kind of scoop, which has a bit of yellow above it (presumably a part of the handle), and which is just digging into a dark mass of what appears to be plastic material. (3) The descriptions of ways in which the meaning of the sentence "infinity broods over all things" (as quoted from Professor Colvin in Titchener's Text-book of psychology, pp. 517-518).

Suggested stimulus words and sentences.

All

Gigantic

Glory

Omniscience

Knowledge is power.

"The darkness falls from the wings of night."

Certainty replaces doubt.

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OF SUBJECTS AND NAMES

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